FOOD Manufacture

A PUBLICATION OF THE LEONARD HILL TECHNICAL GROUP

Vol. 36 No. 12

DECEMBER 1961

Every morning at Reigate

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insist on
REIGATE Brand

NATURAL EXTRACTS
FRUIT & FLAVOURING ESSENCES
TOFFEE FLAVOURS
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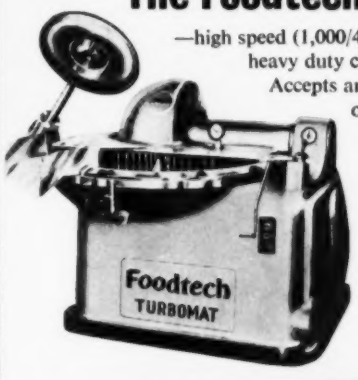
**** Go to Foodtech and get Foodtech Service as well.***

**** Choose from a complete range of food processing machinery.***

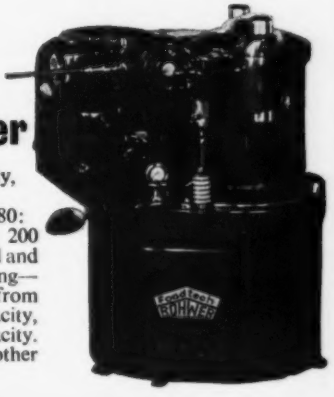
Foodtech have the largest range of food processing equipment in the world, backed by expert, practical knowledge of factory layout and production methods. You can be sure of getting the right equipment and the best advice if you go to Foodtech.

The Foodtech Cut/Mixer



—high speed (1,000/4,000 r.p.m. as desired) heavy duty chopper and emulsifier. Accepts any kind of frozen meat or other materials, cuts cleanly into particles (coarse cut) or produces a smooth emulsion. Also chops and blends fruit, vegetables and butter. Bowl capacities from 20 lb. to 800 lb.

Foodtech Automatic Filler & Linker

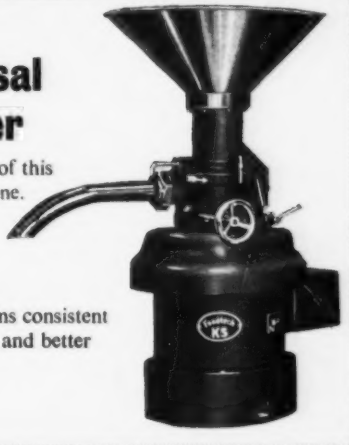


Model A.1: 60 lb. capacity, 120 sausages per minute. Straight filling too! A.L. 80: 176 lb. capacity. Up to 200 sausages per minute linked and weighed also straight filling—air, water or hydraulic—from 100 lb. to 440 lb. capacity, A.L.200: 440 lb capacity. Also available in many other sizes.

Foodtech Automatic Feed Mincer

High speed fully automatic Mincer. Outputs up to 6 tons per hour with only 18 h.p. Smaller models in many sizes.

K.S. Universal Mincemaster



Over 200 satisfied users of this machine in the U.K. alone. Accepts all foodstuffs—even the toughest—and reduces in seconds to a smooth uniform mix that remains consistent for more binding power and better colour.

Foodtech for ALL your needs

Foodtech Ltd.

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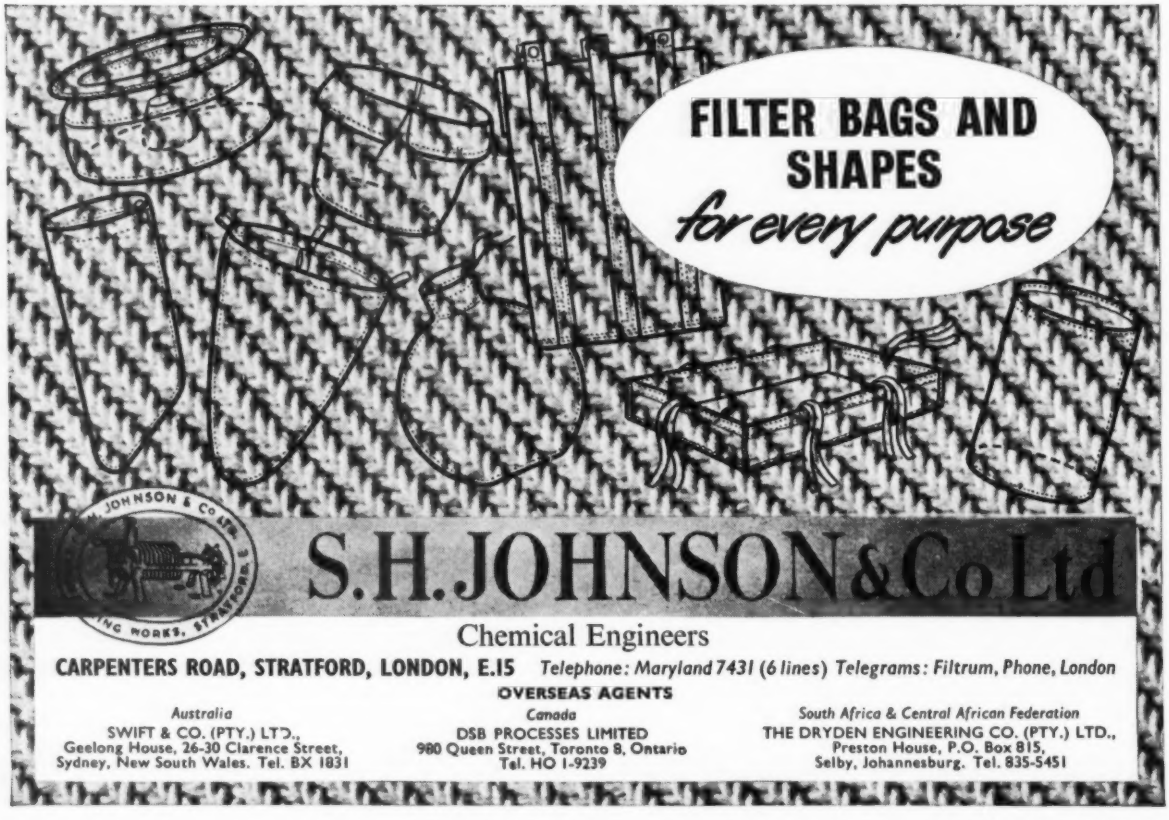
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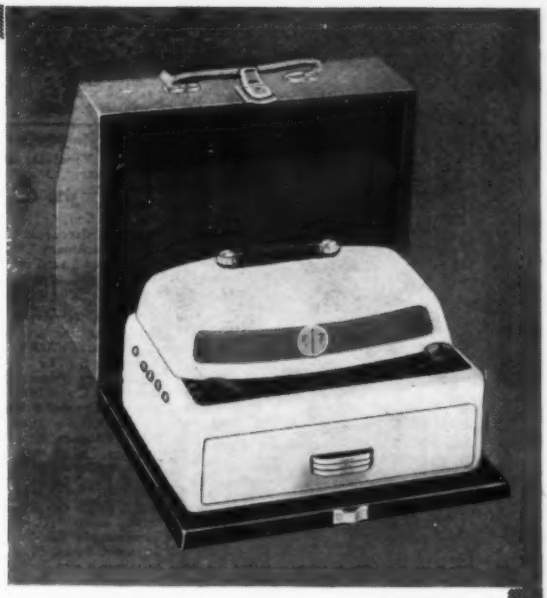
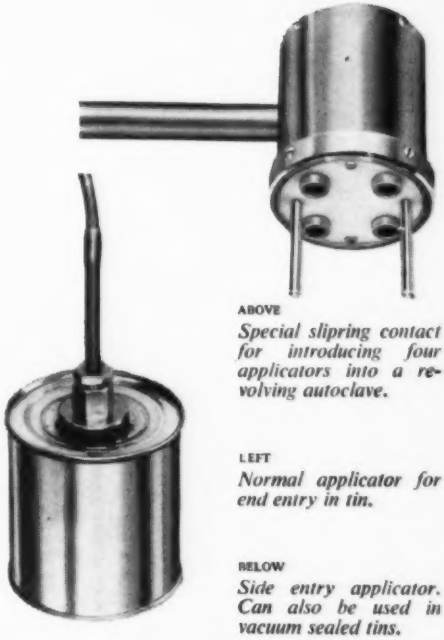
A PRECISION ELECTRIC THERMOMETER *DESIGNED* FOR FOOD MANUFACTURE CONTROL AND RESEARCH



The TEC electric precision thermometer is used by some of the largest tinned food manufacturers in the country, and has many vital advantages which ensure greater accuracy *plus* easier operation.

The thermometer will register up to fifteen applicators at one time, allowing a direct reading. Battery operated, it has automatic compensation for room temperature and a normal range of 0—130°C.

Applicators can be inserted before or after filling and sealing without the use of solder. Types are available for side or end entry into can.



ABOVE
Special slipring contact for introducing four applicators into a revolving autoclave.

LEFT
Normal applicator for end entry in tin.

BELOW
Side entry applicator. Can also be used in vacuum sealed tins.

Users include
Fruit & Vegetable Canning & Quick Freezing Research Association
Smedley's Ltd
Joseph Farrow & Co. Ltd
Crosse & Blackwell Ltd
The Co-operative Wholesale Society Ltd
(Milk and Milk Products Department)

Please write or telephone for further details
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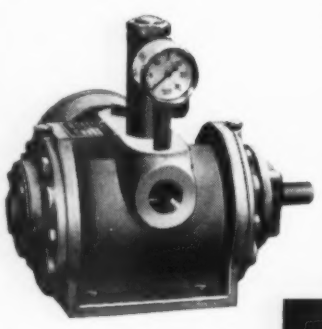
COMPLETELY OIL FREE



WT14

The new REAVELL oil free rotary compressor is based on the well known N.R.D. type compressor/exhauster. In this machine, carbon blades and sealed grease packed bearings replace the conventional fabric blades and ball-bearings. The "RN" type rotary compressor is designed to produce completely oil free air at pressures up to 15 lbs. per sq. in. As an exhauster, this machine works continuously at any vacuum up to 20 in. Hg. It is suitable for coupling to electric motors or small engines, and is also available for use with belt drive.

Oil free reciprocating compressors are also available with wet or dry cylinders for various capacities and pressures.

We shall be pleased to advise you on the application of these machines to your particular problem.

Reavell

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MAKERS OF COMPRESSORS AND EXHAUSTERS FOR ALL INDUSTRIES

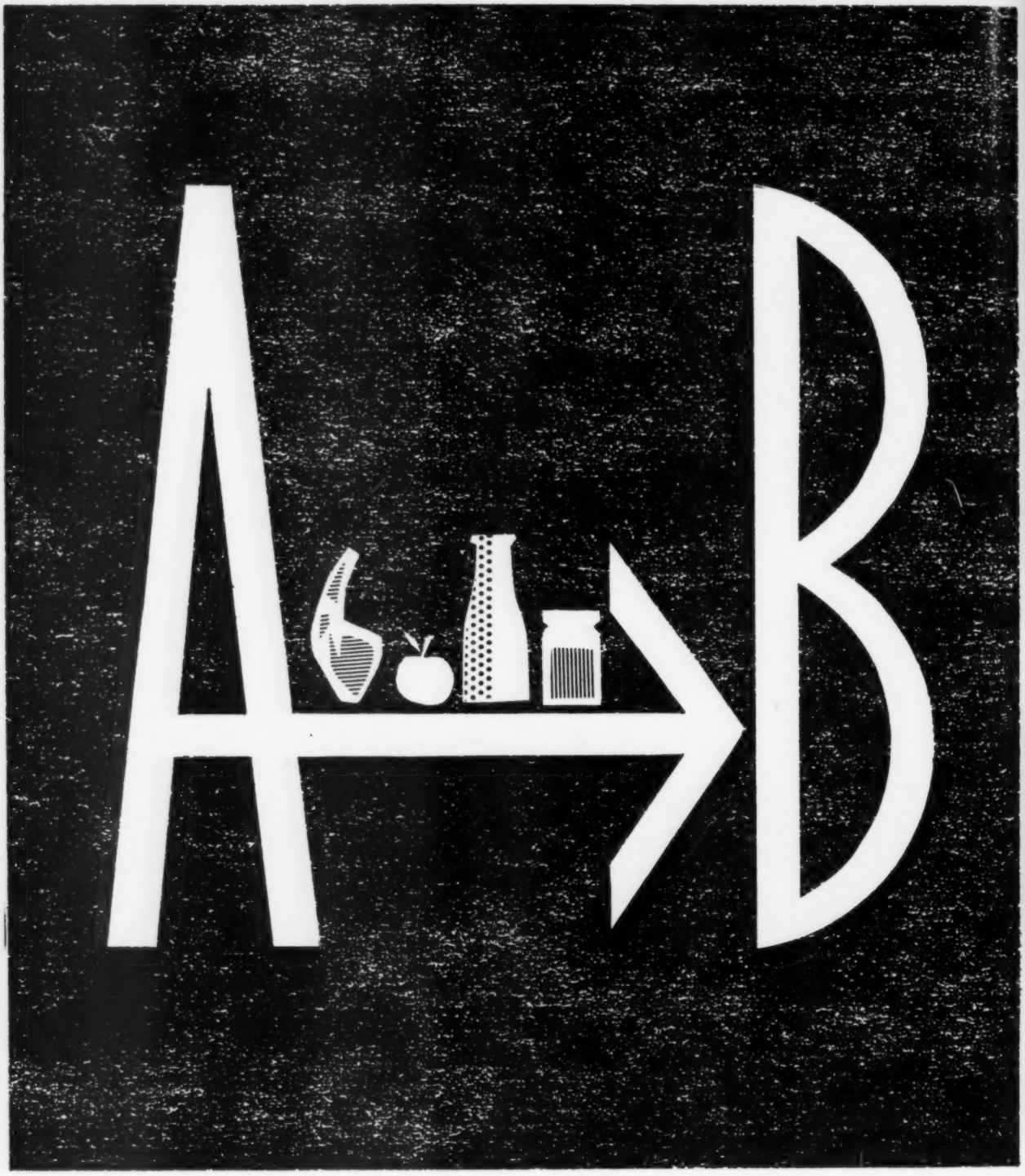
A SMALL WORD ON A PACK MAY SHOW A BIG CHANGE IN PUBLIC TASTE

Haven's Demerara Sugar is their biggest packaged line. There's nothing airy-fairy about it—nothing aimed at the richer end of the market. Yet just recently Haven have thought it worth their while to make a small but significant change on the pack. In the recipes on the back panel they now specify butter—the real thing instead of just a substitute.

This "butter" policy is now reflected in all Haven's recipe material, both on their packs and in their leaflets. For, like many other manufacturers today, Haven realise that a recipe made with butter shows off their product at its very best.

If you're not already recommending butter in your recipes, it is worth thinking about. You'll find that "butter" *pays*.

Issued by the Butter Information Council MERCURY HOUSE, WATERLOO ROAD, LONDON S.E.1 Telephone: WATerloo 5231



The cleanest, most hygienic, most trouble-free way to move food from A to B on a production line is

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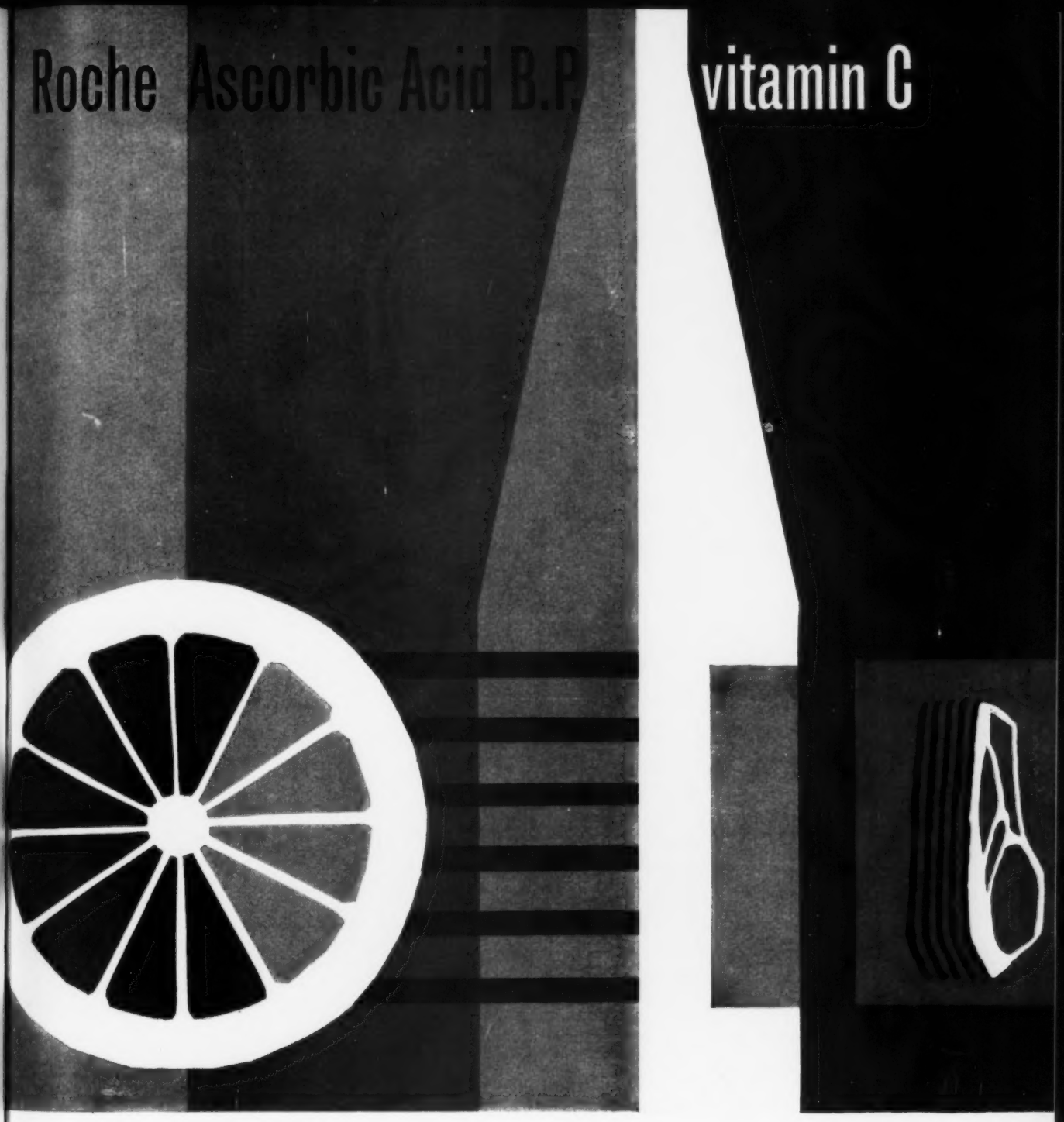

doing good jobs better
to make your product best

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- can reduce curing time significantly in *cured* meats, can give more uniform colour and can help to maintain better colour and flavour during storage, distribution and display.

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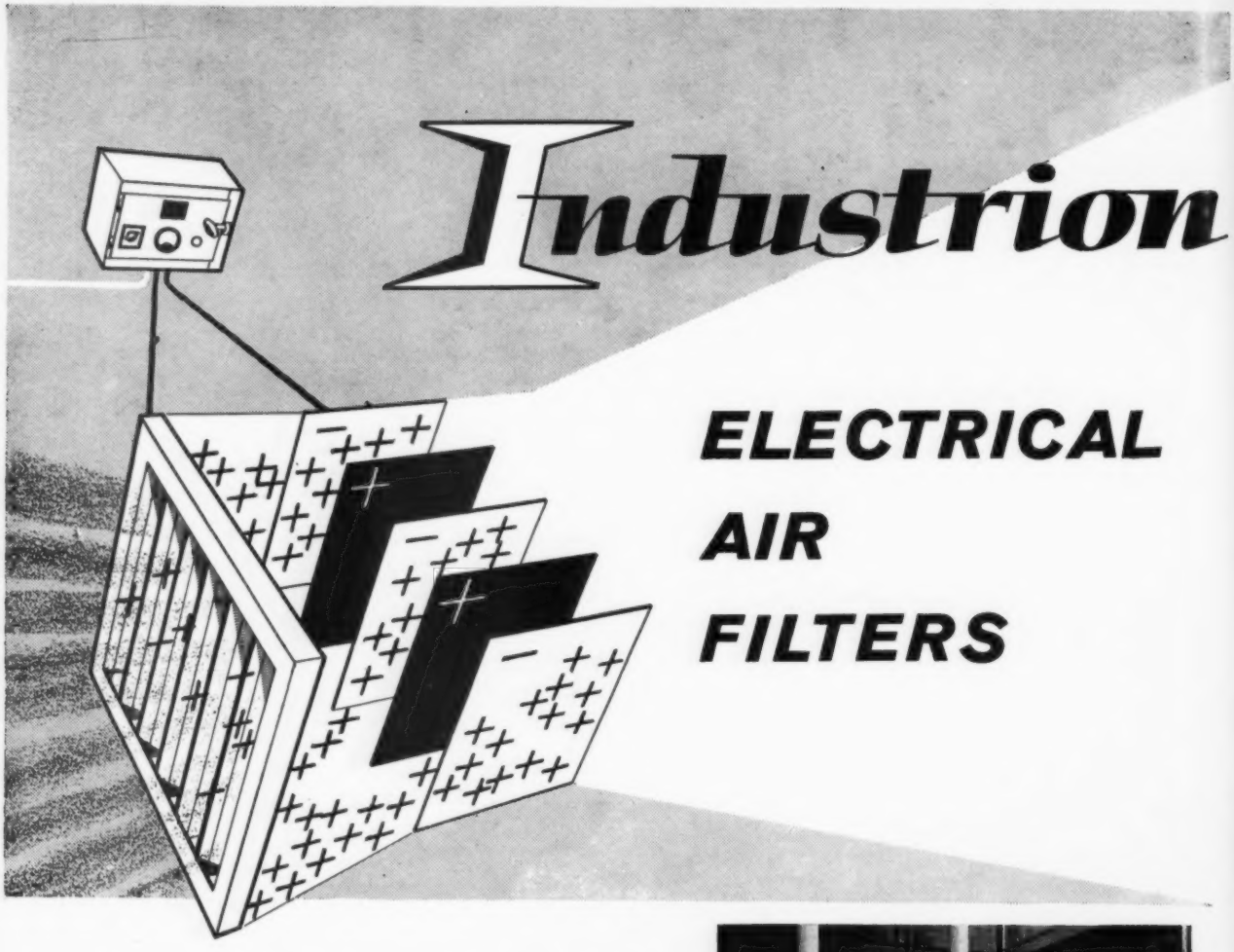

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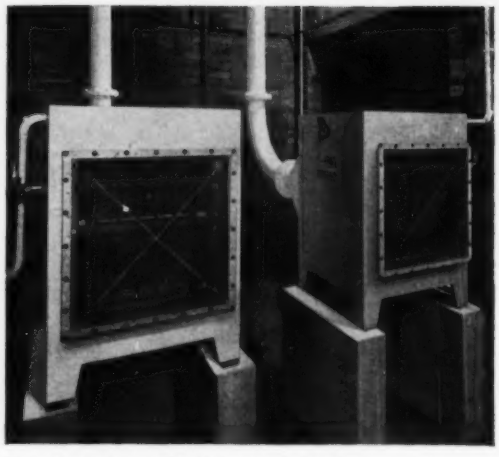
ELECTRICAL AIR FILTERS

In unprotected factories, dust and bacteria are literally as free as air. In many plants, they are unwelcome intruders; potentially dangerous to precision equipment, to production and to personnel.

Industrion Electrical Air Filters, located at strategic points, will remove all airborne contaminents ranging from 60 to .001 microns in size—bacteria averages approximately 1 micron. High efficiency, coupled with the twin advantages of a constant low pressure drop (0.2" w.g.) and low operating costs (only 100 watts needed to clean 10,000 c.f.m) combine to make the Industrion Electrical Air Filter the most effective and economical solution for many air filtration problems.

Full details are contained in Publication No. 86/39 please ask for a copy.



Two Industrion Electrical Air Filters installed at John Smith's Tadcaster Brewery Company Limited. Each filter has a capacity of 500 c.f.m.

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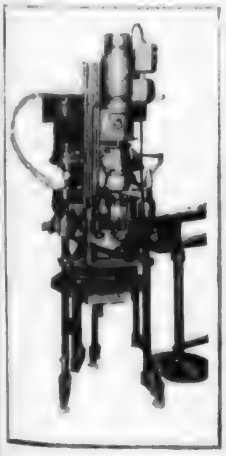
C97

PLASTIC POLYPOTS by Metal Box

Polypots are made of polystyrene; they are well designed, light, tough and splinter-proof. Moulded either clear, or in a variety of brilliant colours, their attractive appearance can be enhanced by Metal Box colour printing on both the pots and the snap-on polythene caps which provide hygienic protection for the contents. Metal Garda caps and paper caps can also be supplied.

For more information write or phone to:



FILL AND CLOSE miniature Polypots with this unique machine. Minimum storage and working area and labour costs make this a really economic proposition.

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THE PLASTICS GROUP OF THE METAL BOX COMPANY LIMITED, 37 BAKER STREET, LONDON W.1. Hunter 5577

MB51/10

Let's be absolutely honest about it. We don't know why so many food manufacturers use our malt products—and they won't tell us.

It must be a very good reason because we sell such a lot to them.

Now, we aren't offering any prizes but we'd be delighted to hear from anyone with a theory; in particular from those food makers we don't yet supply.

Especially if they enclose an order.

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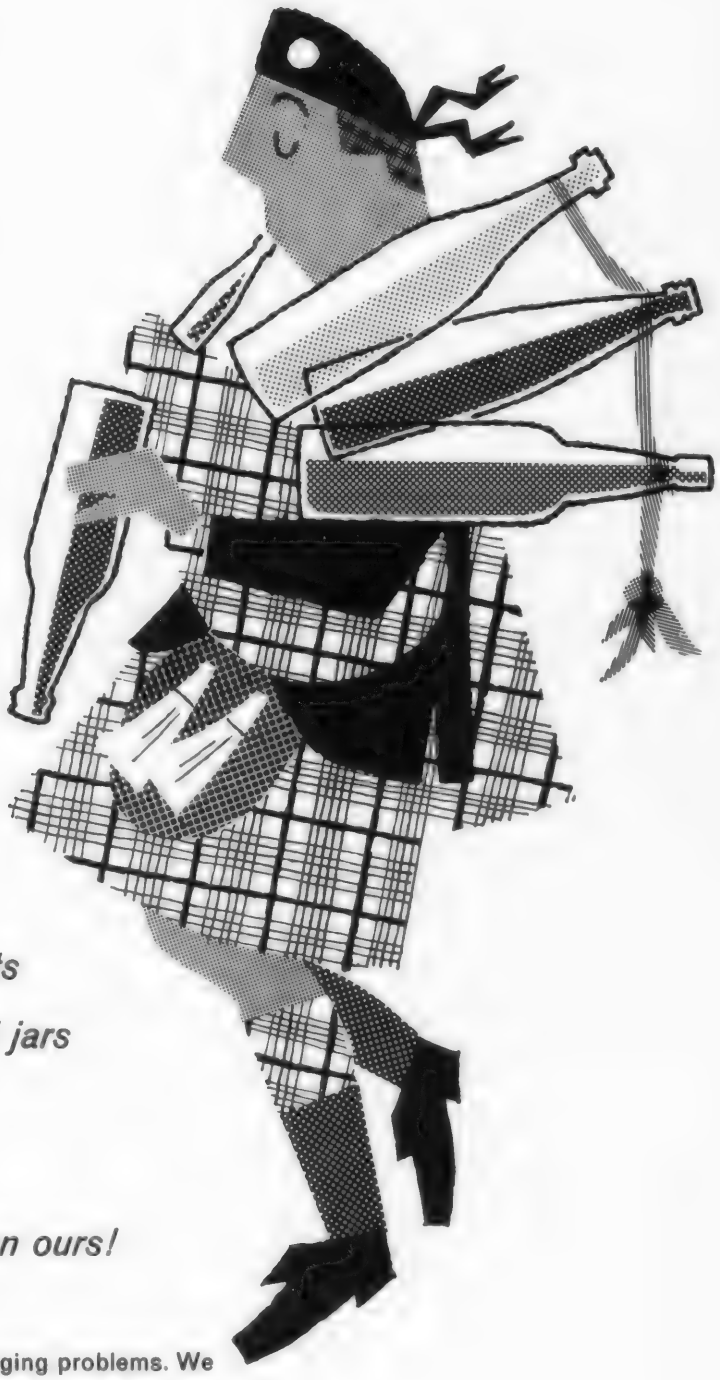

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IN 6FT AISLES THIS TRUCK CAN LIFT 2500 lb 10 FT!

This truck can reach to a height of 10ft. carrying a maximum load of 2,500lb., in aisles only 6ft. wide. It is made by Lansing Bagnall, the largest and most experienced manufacturers of materials-handling machinery in Europe; machinery that can cut the cost, and time, of any handling operation—in all manufacturing, distributive and extractive industries.

Brilliant Features Lansing Bagnall's FRES 2 reach truck, with its extension/retraction design, allows it to stack at right-angles in aisles only 6ft. wide. With the masts retracted the load is carried between the wheelbase—giving excellent stability, and safety for the load and operator.

Low Operating Cost The FRES 2 works a full shift on one battery recharge, at a cost of 1/6d. Batteries are recharged simply by plugging into the nearest power point of standard AC mains supply. For continuous shift-working, batteries can be changed over by one man in a few minutes.

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Instant Accessibility The drive and charge units are completely exposed for maintenance by opening a heavy-plate rear door. The battery is also readily accessible for inspection, and topping-up can be completed in a few seconds.

After-Sales Service Lansing Bagnall offer the most efficient and comprehensive after-sales service in the industry — 14 regional depots throughout the country with over 40 service vans on call 24 hours every day throughout the whole life of every truck.

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You've read the latest achievements in food research. Have you heard the other side of the story . . . the equipment side? The specialists in stainless steel, T.R.F., have come up with yet another success — the 100 gallon tilting pan, illustrated, fitted with a slow speed motor unit, agitator blade operating at 20 r.p.m. and finished in dull polished stainless steel with a mild steel base. Tackling particular problems like this has resulted in one of many hundred success stories from T.R.F. Experience counts. With design, planning and production facts at their fingertips, T.R.F. can put their wisdom to your very good use.

TAYLOR RUSTLESS FITTINGS CO. LIMITED

RING ROAD · WORTLEY · LEEDS, 12

Butcher's van lined with 'Darvic' p.v.c. sheet and built by Calder Coachbuilders Limited, Albion Mill, Cotton Street, Burnley, Lancs. for Messrs. F. Lord & Son, Ltd., Greenbrook Works, Lower House Lane, Burnley.

'Darvic' makes an ideal lining for food delivery vans

Darvic' rigid p.v.c. sheet is the ideal panelling material for making the interior of delivery vans really good looking and thoroughly hygienic. More and more fleet owners, particularly in the food trade, are proving this on their own vehicles.

'Darvic' combines very light weight with rigidity, even in thin sheets. It is easy to clean, never needs painting and its glossy surface *lasts*. If you would like more information about 'Darvic' and the I.C.I. Technical Service that goes with it, any I.C.I. Sales Office will be glad to help you.

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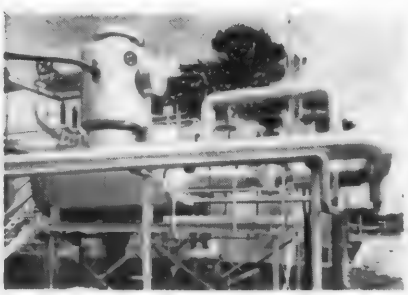
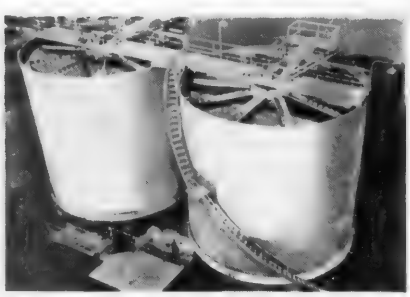


Kennicott pressure type deaerator installed in a synthetic rubber plant.



Coagulation and settlement tanks associated with a complete lime soda softening plant at a large steelworks.

Deionisation plant consisting of cation exchanger, anion exchanger, scrubber tower and mixed-bed deionisation unit.

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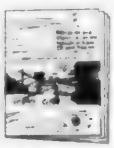

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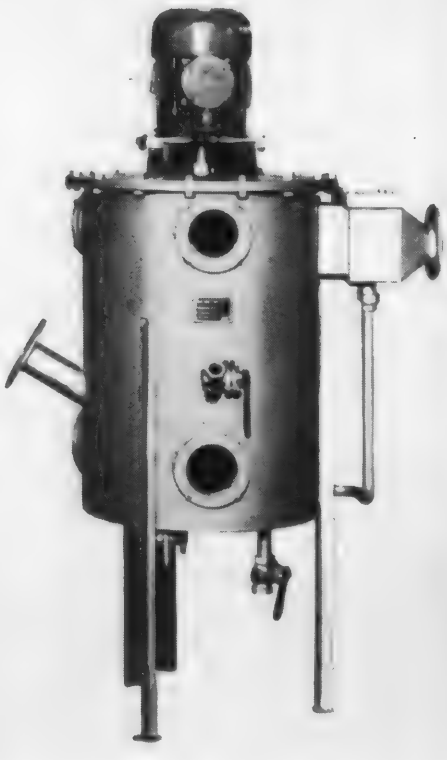
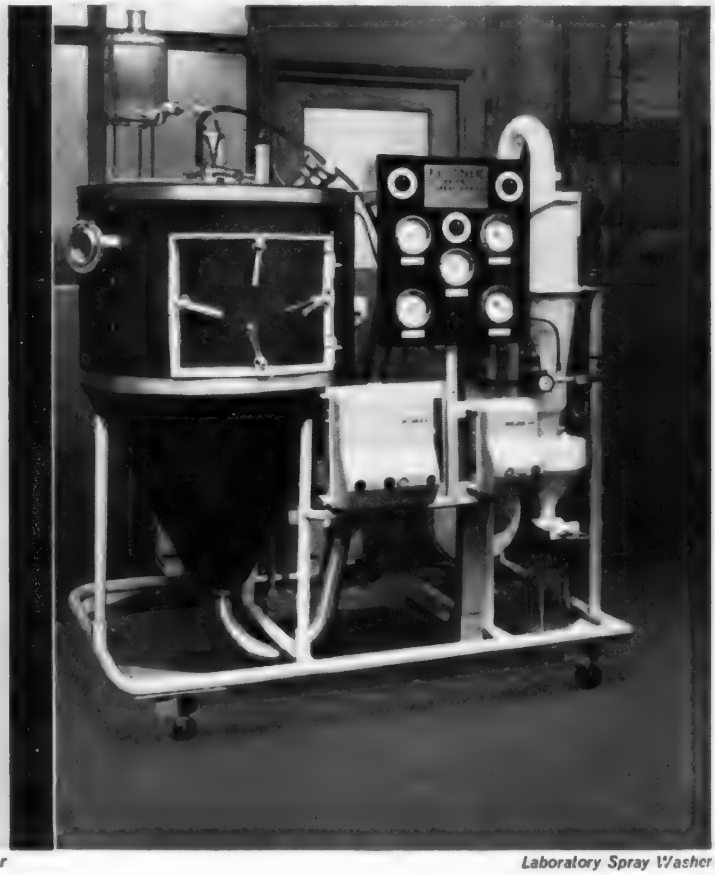


Laboratory Gas Washer



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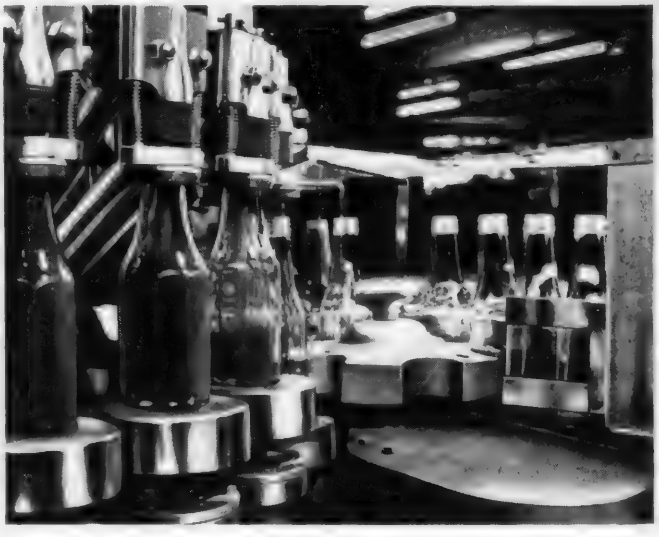

Like so many important food manufacturers, Messrs. Crosse & Blackwell Ltd. depend on ALBRO automatic filling machines to maintain big, sustained output.

The ALBRO 24-head vacuum-operated machine illustrated is one of many installed at the Crosse & Blackwell factories. It shows bottles entering on the feed side for tomato ketchup filling.

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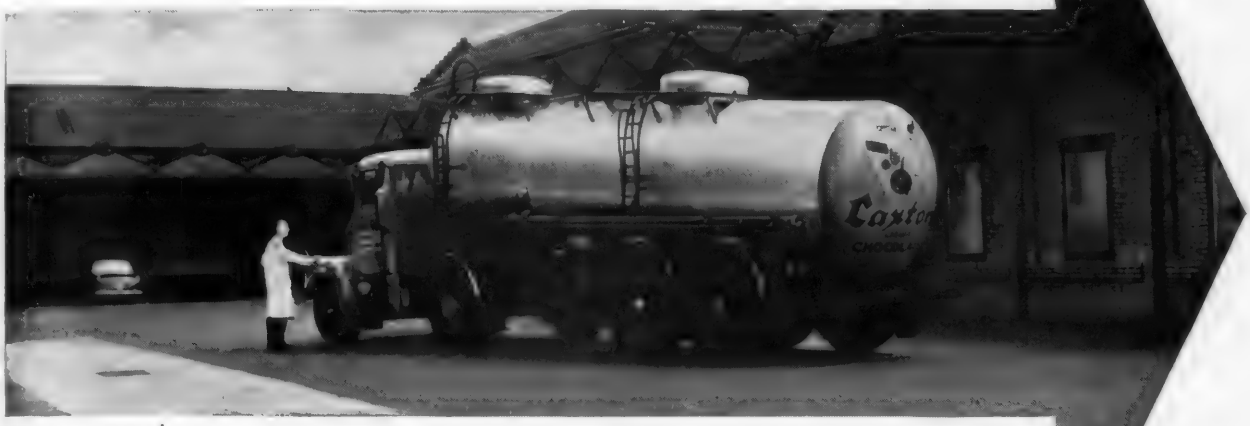

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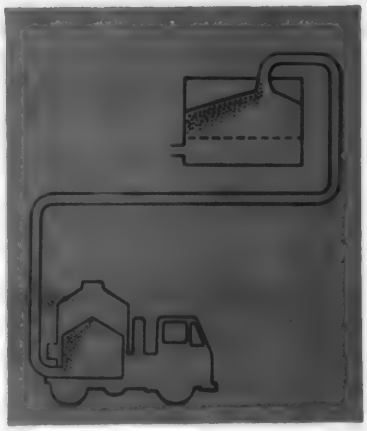

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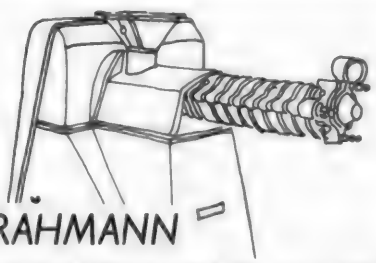

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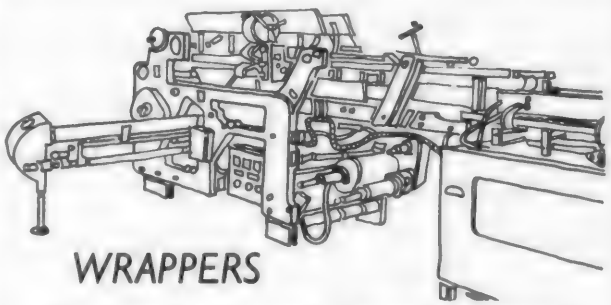

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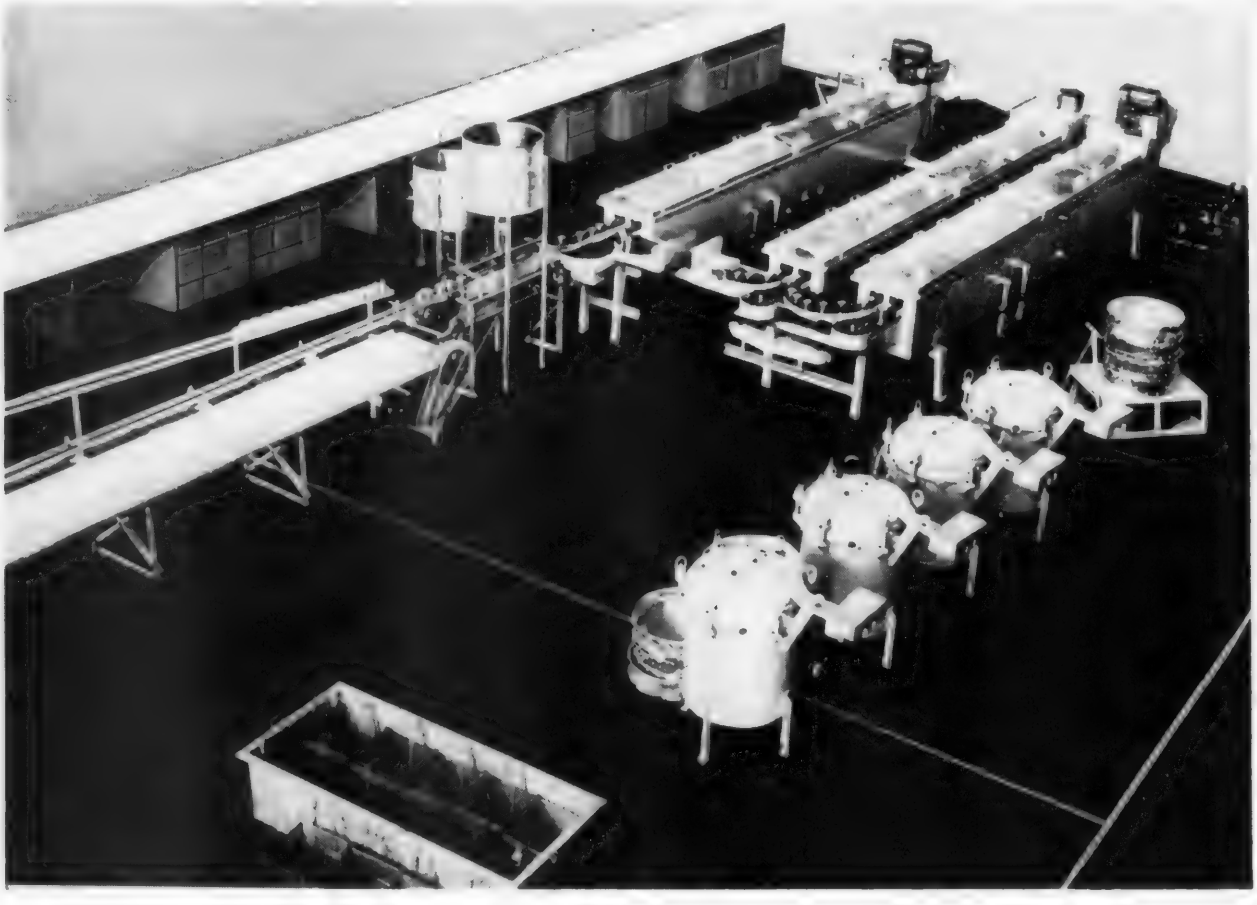

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10 It can be applied at any desired speed, without waste, with fast Signode hand tools, power tools, and automatic machines.

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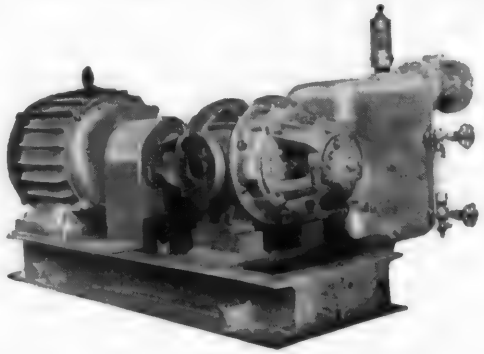

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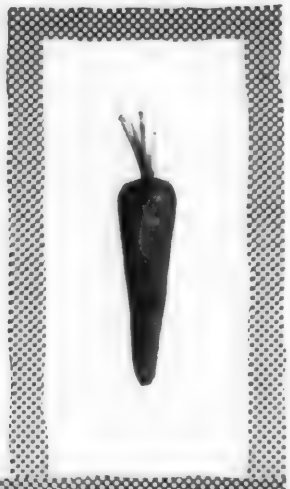

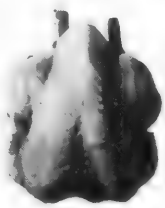

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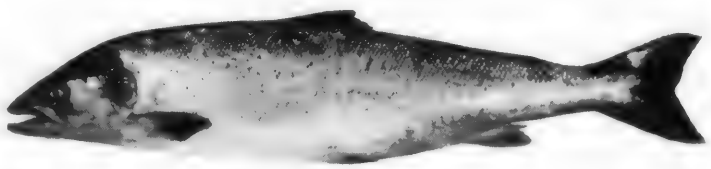
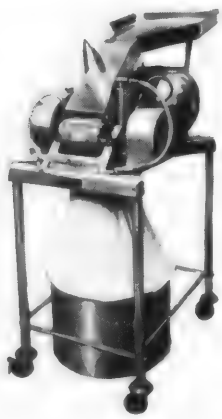
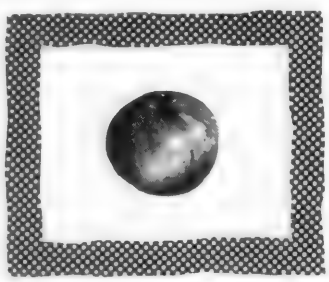
The unique Manesty Fitzmill is an indispensable piece of equipment in the food trade. The Fitzmill is a comminuting machine with an exclusive reversible comminuting chamber. The unique design allows most of the work to be carried out 'impact in air'. The Fitzmill is extremely versatile and is put to such uses as reducing vegetables, fish or meat to a paste or purée, grinding fruit, nuts and beans, blending the dry ingredients of packaged foods and breaking down raw products to fine particles. The correct combination of speed and screen size permits food to be processed to any desired size. As there is no metal to metal contact in the comminuting chamber there is no danger of metal contamination to the foodstuffs. The Fitzmill is available with fixed or swinging blades. Knife edge for sizing, chopping or granulating. Impact edge for puréeing, pulverizing and sizing. May we send you further details of this and the full range of Manesty Machines?







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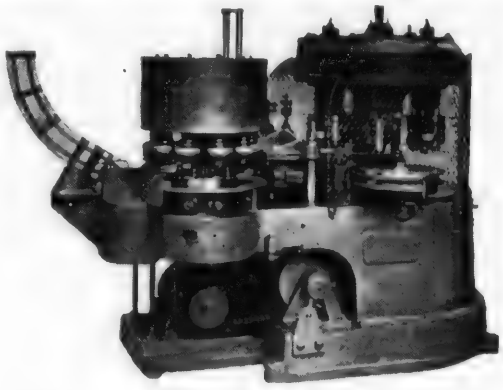

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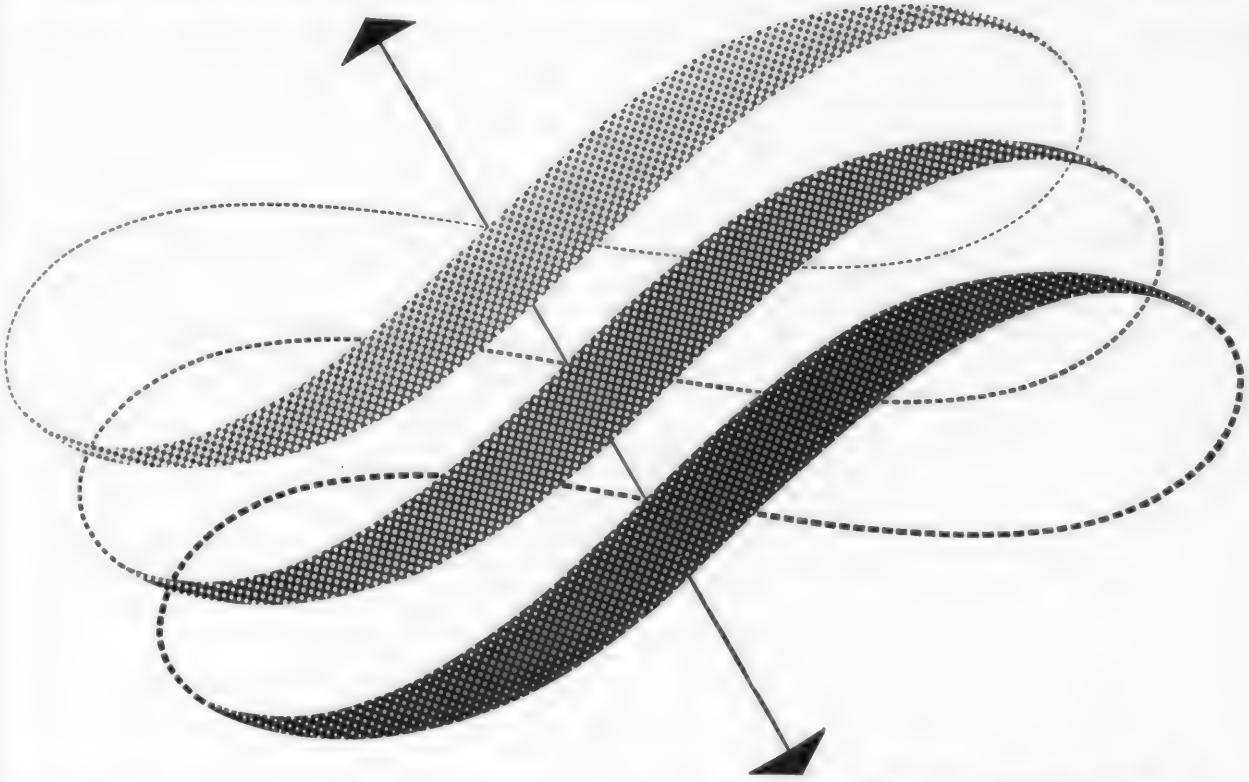

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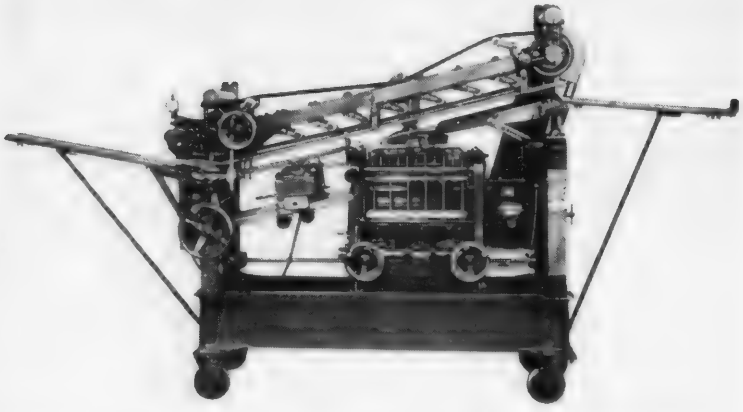

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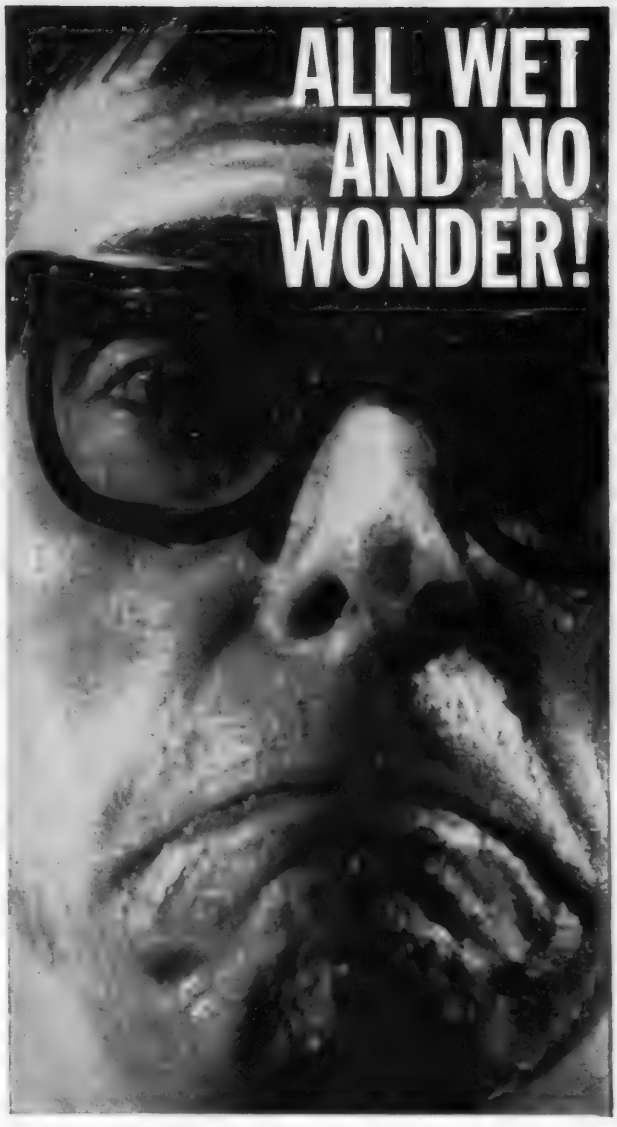

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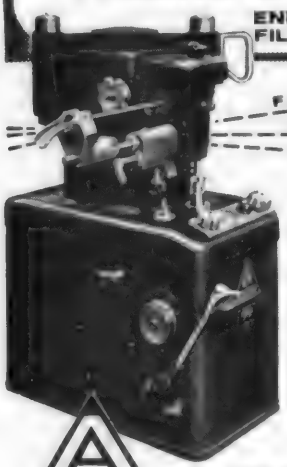

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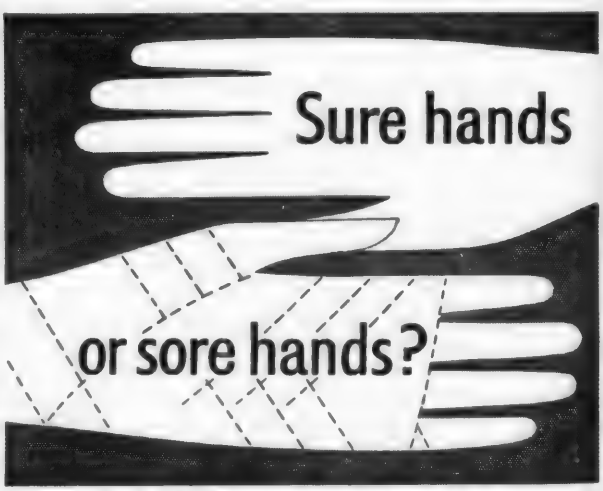

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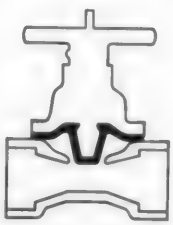

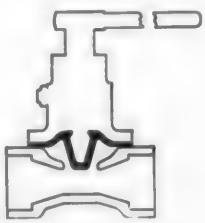

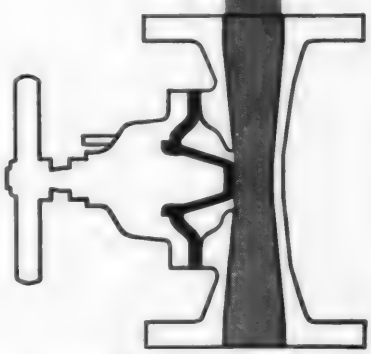

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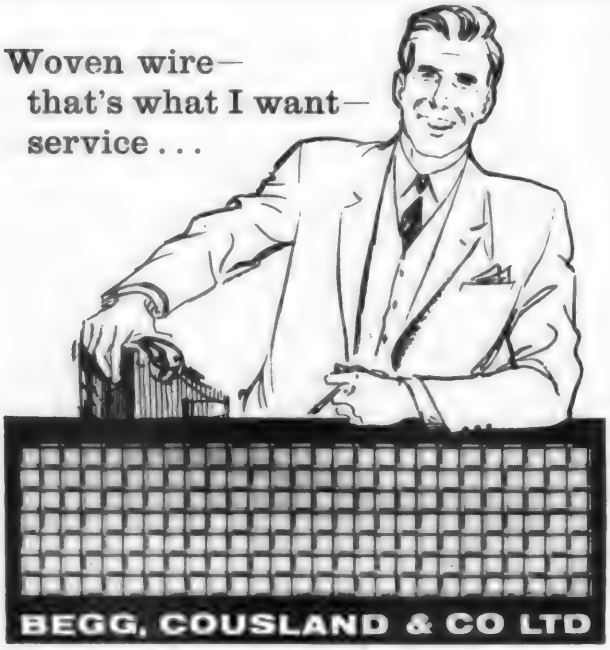

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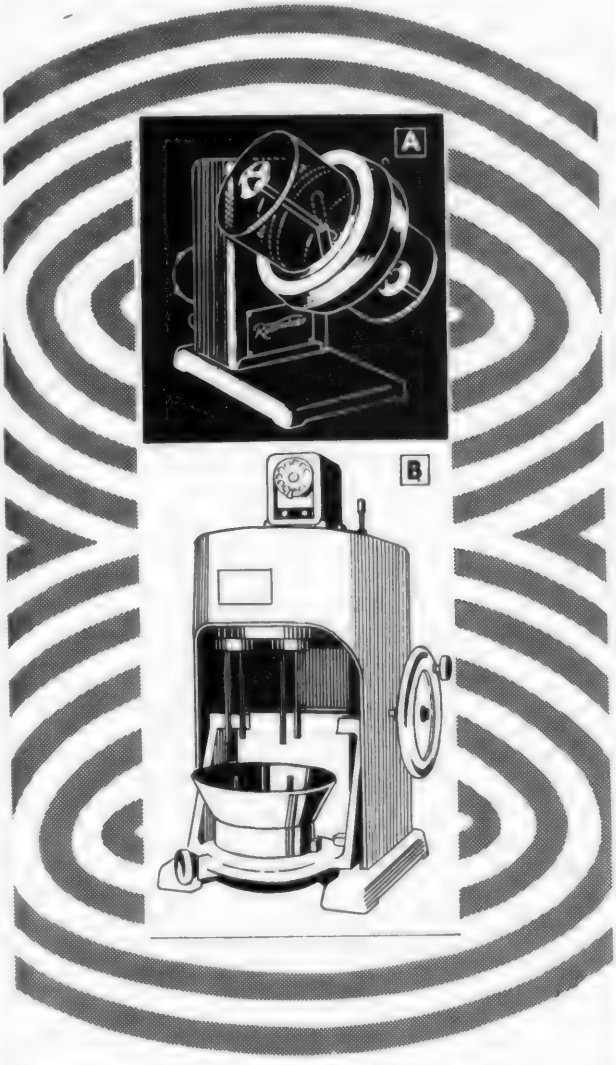

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FOOD
Manufacture

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FOOD
Manufacture

Vol. 36, No. 12 December 1, 1961

Fifty years behind in pig processing

SOME forthright and what many would consider highly controversial topics were deliberately touched upon by Mr. Thomas Shaw, director of pigs of the Fatstock Marketing Corporation, when he opened the new pig processing factory of W. H. Smart and Co., Ltd., at Redditch on October 12. This factory, although primarily a bacon factory, is more than that, for it is also equipped to handle the manufacturing by-products and has a department for producing pies, sausages, etc.

The heavy capital outlay by Messrs. Smart on modern processing machinery, particularly slaughtering plant (among which the CO_2 anæsthetising plant is noteworthy) shows considerable commercial courage and a great faith in the future of British bacon at a time when the industry is facing heavy competition from abroad and fiercely divided opinions at home, difficulties which are not likely to be eased when and if Britain enters the Common Market.

Mr. Shaw bluntly said that in the matter of commercial equipment Britain is fifty years behind Denmark, Holland and Sweden, with Northern Ireland overtaking us and racing ahead. This indictment of Britain's pig processing industry by one who should know indicates, we feel, the basic reason why British bacon, which at its best is the finest in the world, fails to compete with the imported product. It is significant that all the slaughtering equipment at Smart's was Danish, beautiful stuff which surely our machinery makers, second to none, could build equally well if they chose. But we have let foreign interests get a foothold which is now next to impossible to dislodge.

Mr. Shaw had a lot to say about the economics of pig breeding. There is a lot to be said for his contention that to allow the pork, bacon and manufacturing trades to compete is folly. Logically the pig is an entity, part of which goes to bacon, part to pork and the rest to manufacturing, and the trend in bacon factories today is in harmony with this. It logically follows therefore that the selling value of a pig should be based on deadweight and grade, irrespective of the purpose for which it is intended.

Mr. Shaw rightly pointed out that the ultimate arbiter in marketing matters is the housewife, and it is she, therefore, who determines production policy on the farm. The pig producer, processor and the retail grocer or manager of self-service store or supermarket form a team whose job it is to provide the housewife with what she wants, and it is up to the team members to co-operate in this. Yet, Mr. Shaw contended, under present arrangements the grocer and the curer, and even the large marketing organisations have no say in the shaping of agricultural policy.

These political considerations aside, the sooner the British pig processing industry pulls up its socks and gets up to date the sooner will costs come down, the pig jungle sorted out and British bacon compete on equal terms with its imported counterpart.

"A real hot subject"

WE DOUBT whether the organisers of the A.F.D. symposium at the Borough Polytechnic on October 19 and 20 really expected 400 people to turn up. The fact that the main hall proved inadequate and that the overflow had to be accommodated in a second hall equipped with closed circuit television so that the occupants could follow the proceedings speaks for itself. If the organisers had set out to sabotage the British food industry by withdrawing from active commission for two whole days practically all its key technologists, they could not have succeeded more, for the 400-odd audience consisted of representatives from a large number of food processing firms, food machinery makers and other interested parties both at home and overseas. A noteworthy point was the presence of a number of people from firms who, on the face of it, have little intention of entering the A.F.D. field. "We are here to find out what's going on" was the typical comment from one such, showing that A.F.D. is, in the words of Mr. F. K. Lawler, editor of *Food Engineering*, who spoke on freeze-drying progress in U.S.A., a "real hot subject."

It was obvious that many of the delegates knew little about the technicalities of A.F.D. and were keen to learn about the fundamental principles and

commercial possibilities of this new method of food preservation. The average participant was more concerned with basic and simple facts concerning what A.F.D. had to offer him rather than with mathematical equations of sublimation phenomena and graphs of vapour pressures; the opening lecture by Dr. R. I. N. Greaves—"General Methods of Freeze Drying"—was an exposition of this complex subject which for brevity, comprehensiveness, clarity and expression in simple terms which even company directors could understand can only be described as masterly. This set the tone for the whole symposium which some later speakers unfortunately did not always follow.

A.F.D. explained in basic terms

THE OBJECT of the symposium was a clear and simple exposition of A.F.D. techniques in terms which could be understood by intelligent persons who did not want too much delving into technicalities. In the main this was what the symposium achieved, although one or two speakers introduced unnecessary technical detail. It was unfortunate also that what could have been some of the most interesting lectures were marred by poor delivery, which only proves that very often those who are most talented at carrying out a brilliant piece of work are not always the best at describing it.

The arrangement of so many lectures in such a short time meant that unless the speakers kept rigidly to their allotted time the timetable would become disorganised. This is in fact what happened on the first day, and valuable discussion time, little enough as it was, was lost. The chairman of the morning session on the next day, determined that this state of affairs should not be repeated, pruned speakers' times so ruthlessly that we feel some unfairness crept in; after all, if a speaker has been told he can speak for 45 minutes it is a little unfair to tell him on the platform that he has only 20. Such a thing is hardly fair on the audience either.

These criticisms aside, the symposium was a resounding success, and the organisers are to be warmly congratulated. As was to be expected, a number of the Aberdeen team of workers were among the speakers, and one thing which the symposium highlighted in marked degree was the scattering of the members of this team, whose talents are now in many cases being used by other countries. The value of a team is more than the sum total of the individual members; although the break-up of the Aberdeen team is now ancient history and no purpose is to be served by poking over the ruins, we cannot help feeling that the failure to keep the team together to continue its work was a deplorable piece of irresponsible folly.

Mendacious advertising does harm

SOME while ago we crossed swords, metaphorically and in a friendly way, with a director of one of our leading companies who took exception to some remarks of ours concerning suggestive and misleading advertising. He chose to assume that our remarks were directed in particular against his company's advertising policy; he also indignantly resented our suggestion that some advertising people (he assumed that we meant *his* advertising people although we had not said so) deliberately dug out all the medical evidence they could find in favour of a particular product, food, ingredient, proprietary medicine or what have you.

In regard to the first assumption, that we were referring specifically to his company—if the cap fits, wear it! In regard to the second item, this is what appeared recently in *The Lancet*:

"Recently a public relations firm representing a number of different interests telephoned a medical practitioner to say they wished to 'promote' big breakfasts. They wanted a medical article describing how important it is for health to eat a big breakfast. The doctor replied that in his opinion this was not universally true. He thought that some people could certainly do with eating more breakfast, whereas others could do with less, and he offered to write an article giving his honest opinion. He was then asked whether he could write only about people who ought to eat more, without mentioning the rest. He declined and was told that they would find someone else."

Everyone is familiar with claims and statements made in advertisements that are obviously so exaggerated and untrue that they merely raise a smile. Advertisements which suggest rather than state are more pernicious, and the number of persuasive advertisements which misinterpret, distort and ignore scientific evidence for the sake of selling more goods is steadily increasing. There is now a science devoted to this kind of advertising—motivational research, it is called—and its purpose is not the noble one of uncovering truth but the base one of prostituting the discoveries of psychology in the service of Mammon. The specious argument that the customer is merely being given what he wants is liable to become a boomerang, for when the worm discovers how he has been deceived he is liable to turn. This accounts for the steadily increasing popularity of such publications as *Which?* and *Shoppers' Guide*, mention in which can do more good or harm to the sales of a product, depending on whether the mention has been approving or otherwise, than the spending or otherwise of thousands on advertising.

In our modern society advertising is necessary and desirable in order to spread information about what

is available, but it must tell the truth. To end this brief homily on advertising ethics on a bright note we quote the following from the aforementioned article in *The Lancet*: "The one field in which direct advertising to the lay public is probably to some extent beneficial is in baby foods. These are often sold along with a good deal of advertising material which is mostly informative rather than persuasive, although unfortunately much of it is some ten or twenty years out of date."

The mysteries of fish migration

THE INEXHAUSTIBLE riches of the sea could be harvested much more abundantly and profitably if more were known about fish migration, a subject which, in spite of the discoveries of science, remains largely wrapped in mystery. That this is no academic problem of interest only to those few whose business it is to study the ways of fish but a problem of vital concern to food processors, was forcibly brought home to us when we recently visited Egersund in South-West Norway during the Food Group Summer Tour. There in that fishing port we saw moored trawlers and an idle fishmeal plant, all disused because herring, once abundant off that part of the Norwegian coast, have in recent years changed their migrating habits, truly a disaster for the herring fishing industry of South-West Norway.

At one time the herring every year in due season came in from the Atlantic and on approaching the Norwegian coast turned south, traversed the southern tip of Norway and went through the Skagerrak into the Baltic. One year, for no reason that anybody knows, they turned north at the Norwegian coast and went round the North Cape. They have been doing this yearly ever since. The Russians no doubt are delighted, but the Norwegians have been dismayed.

Turning from the sad story of the herring to the happy story of the tuna, world tuna catches have jumped in recent years from 500,000 tons in 1952 to more than 800,000 in 1959. The major part of the increase has been taken by the Japanese, whose fishing vessels operate in all the seven seas, but other nations are fishing for tuna off the coasts of West Africa and in the North Sea as well as in the oldest tuna fishing ground of all, the Mediterranean. But nobody knows for certain what are the migratory habits of this fish or where they go in any of their seasonal movements. To avoid overfishing and depletion it is necessary to know the tuna's full life story and the environment in which it lives, and to understand the dynamics of its population. These and other problems are to be discussed at a World Scientific Meeting on the Biology of Tunas and Related Species, convened by FAO and to be held in California in July, 1962.

Problems of imported foods

EVERY year the Port of London alone handles food imports totalling about 1,250,000 tons valued at about £700 million. Of this, meat accounts for 550,000 tons valued at about £190 million. Approximately half of all food imports and 60% of total meat imports pass through the port.

These figures were quoted by Dr. W. Stott, reading Dr. Greenwood Wilson's lecture to the Royal Society of Health recently. The lecture dealt with the health problems arising from the fact that practically every item of our basic diet is made up, to greater or lesser extent, from imported foods and that standards of such foods have to be continually checked with great accuracy.

In past issues we have dealt with the problem of salmonella contamination of desiccated coconut from Ceylon, but this is only one of the foods which have at various times been so heavily contaminated with salmonellæ or staphylococci that whole shipments have had to be burned, others being egg products, prawns, liver and horsemeat. Tea from certain countries, mostly Formosa and Indonesia, have at times been contaminated with lead from the artificial colouring used in the tea.

A few years ago a significant increase in imports of liver for animal consumption only drew attention to the fact that no control over the subsequent use of the liver existed, and it was discovered that some was finding its way to chain retail butchers' shops. Examination showed that a high proportion of the liver was infected with the Echinococcus cyst, a stage in the life cycle of the dog tape worm, and was the cause of at least one recorded human death.

Imported meat was sometimes found to have a high salmonella and clostridium content, particularly meat from a country new to the trade. Visits by Ministry veterinarians to the offending slaughterhouse achieved improved results. It is understood that structural alterations to the slaughterhouse and improved sanitation were put into effect as a result of the visit.

The problems connected with desiccated coconut have been widely publicised and we referred in our October issue (p. 412) to regulations made by the Ceylon government. It is understood that four or five mills in Ceylon now satisfy these requirements (what about the others?)

Imported cheese has at times caused anxiety among health authorities and food poisoning outbreaks among consumers; two of the latter occurred at hospitals on the very day that officials of an exporting country called to explain what steps their government were taking to eliminate the contamination. The picture presented is one of eternal vigilance by overworked health authorities.

Bad, unfair and wasteful . . .

. . . were the terms used recently by Lord Rank to describe the present system of yearly appealing for subscriptions by the research associations. He was speaking at the annual luncheon of the British Baking Industries Research Association, whose chief guest he was, and every one of his remarks, in a forthright speech made entirely without notes, was pertinent and thought-provoking. "We millers can show you a better way," he went on, saying that their system was to have only one annual subscription (apart from the benevolent fund) from which was taken the various sums needed for advertising, the research association, etc.

"Unjust" was the epithet he used to describe the voluntary system of financing the research associations, because, he said, many are obtaining benefits for which others are paying. "A lot of people are riding on other people's backs" was the phrase he used. He instanced the fact that only about 1,400 bakers subscribe to the B.B.I.R.A. out of a possible 10,000 or so.

These remarks, justified as they are up to a point, need some qualification. Fourteen hundred out of ten thousand may sound a very small number, but in fact the fourteen hundred cover a large proportion of the country's bakery production. The picture of a lot of layabouts riding on the backs of a few noble stout-hearts gallantly bearing tremendous loads therefore becomes transformed into one in which a number of pigmies clamber on the backs of several elephants. Would the elephants notice very much if the pigmies fell off? Then, too, the bakers outside the association's fold do not equally share the fruits of research. Research reports are distributed only to members, and non-members cannot call on the association to help them with their problems. If they wish to plough their own furrow, the best of luck to them.

We emphatically believe that research associations are a good thing and that every effort should be made to persuade all to join. But the temptation towards compulsion should be resisted. There should be no suggestion of a closed shop, and we believe that in the long run society works best on a free and voluntary basis.

Incredibly boring . . .

. . . were the papers issued by the research stations, said Lord Rank; but, he added, when he visited a research station he became very interested and enthusiastic. Writers of research reports, please note! There is no reason why technical papers should be as dry as dust; if they are, it is because the writers have not the art of expressing themselves clearly, concisely and in an interesting manner—in short, they suffer from the malady afflicting 95% of scientists and technical men.

The unintelligent need not read this

INTELLIGENT people, or so it seems to us, are a tiny minority in the world today. "Ay, Maggie," said Angus to his wife, "all the world's quaire 'cept me and thee, and thee's a bit quaire sometimes." You, reader, are obviously in the small company of the elect, for had you been unintelligent you would hardly have picked up and opened FOOD MANUFACTURE, let alone read thus far.

Intelligent people are those who have ideas and the ability to carry them out. The vast majority, the unintelligent, the common herd, have no ideas and do as they are told. Dictatorships flourish because a few intelligent people, evil perhaps, but nevertheless supremely intelligent, rise to the top and tell the common herd what to do, and the common herd do it willy nilly.

Not all intelligent people, thank God, are evil. You, reader, are, we trust, among the good intelligent ones. For it is for the intelligent people of our food industry that FOOD MANUFACTURE exists, the few at the top, the ones who have ideas and get them carried out. To the unintelligent this journal would be of precious little use. The wise man realises his education is never finished, and the doors of his mind are ever open to learn more. This journal aims to educate—no less—the intelligent leaders of our industry. Not that the editorial staff lay claim to superior wisdom—heaven forbid. Their task is to be the channel through which intelligent people can inform each other. It is one thing to have ideas, and quite another to communicate them. This is where we come in. If you have an idea or know about something you think would interest others, write it out and send it to us.

Too many intelligent people refrain from writing because they imagine they can't write, can't spell or don't know the subtleties of English grammar. Here, again, this is where we come in. Our task is to make the rough ways plain, to smooth the clumsy phrase, to correct the awkward grammar. We want the ideas; the method of expression can, within reason, be recast if necessary.

"Better to keep silence and let people think you are a fool than to open it and remove all doubt" is a good motto for morons but a bad one for intelligent people. To be morbidly afraid of saying the wrong thing is to betray a reprehensible self-pity. Often saying the wrong thing can do good, because someone else may be prompted to say the right one, and so the truth will be revealed. This is the principle of dialectic, to which we are devoted.

World's Largest Crispbread Factory

120 tons a day from automatic Swedish plant

By B. D. Malmborg

This month in our series of factory articleswe turn for a change to a factory overseas which is the largest and most highly mechanised in its field, and which will be of interest in view of the increasing imports of Swedish crispbread into this country. The following article by a Swedish correspondent describes the Wasa Crispbread Factory at Filipstad and gives interesting details of processing.

THE Wasa Crispbread Factory at Filipstad, Sweden, has developed in the short space of twenty-five years from a small private bakery with a staff of twenty into the world's largest crispbread factory which manufactures more than half of all the crispbread consumed, using the most modern methods of automation.

During the whole of this development the factory was directed by its energetic and far-sighted owner, Consul K. E. Lundström, who never ceased to improve and extend it, regardless of obstacles. When the flour bought from different mills caused variations in the quality of the crispbread he started to build a mill at his own factory where he could control the product. When he could not obtain the modern machinery which he desired for automation, then he took on a staff of designers and technicians and built his own specialised machines. In 1959 his son, Ulf Lundström, took over as director of the Wasa Factory, and has most successfully continued the development on modern lines.

(*Above*): **The dominating aspect of Wasa's silos is well brought out in this photo.**

(*Left*): **Some of the 32 new roller mills.** (*Right*): **A battery of dough mixers, in which mixing proceeds entirely automatically.**

Facts and figures

The present-day factory is 1,300 ft. in length, with a floor area of over 110,000 sq. yds., and a battery of grain silos each 180 ft. in height, with a total storage capacity of 26,500 tons of grain. The factory uses nearly 60,000 tons of rye and 1,000 tons of yeast yearly to produce a daily output of 120 tons of crispbread. Every day half a million quarter-kilo packets of over 15 varieties leave the Wasa factory. Sweden itself takes three-quarters of its entire crispbread consumption from this firm, and the annual export to countries in all parts of the globe amounts to 20 million pounds weight, including 2 million pounds exported to U.S.A., which is Wasa's largest overseas customer.

The number of employees in the whole concern is about 1,100, plus some 200 persons engaged indirectly in distribution. The annual wage bill amounts to some 15 million Swedish kroner, or just over £1 million. The factory works continuously day and night from Monday to Saturday on a 3-shift system, and the electricity consumption totals over 65 million kilowatt hours a year.

The process described

This Filipstad factory, which lies midway between Stockholm and Gothenburg, is probably the most automated of all existing crispbread factories, and the working procedure may be summarised briefly as follows:

1. The rye is analysed before reception by means of automatic sampling techniques, which take place as the rye is transferred from the railway truck to a small cell in a battery of control silos nearby. The approved rye is taken to the classification silos, from which it is mixed in certain proportions before entering the homogenising silos. The mixing is done automatically over an operating centre.

2. The rye is transported to the storage silos, cleaned, conditioned and milled to 100% whole rye flour.

3. The flour and other ingredients are kneaded to dough after automatic adding of various components according to the recipe programmed from an operating desk.

4. The dough is allowed to leaven for some hours.

5. It is shaped into square semi-fabricates.

6. Proofing for about half an hour.

7. Baking for a bare 10 minutes.

8. Drying for 5 to 6 hours.

9. Stored.

10. Sorted.

11. Sawn into slices.

12. Packaged.

13. Packed for distribution by railway and bus.

The raw materials for the Wasa crispbread consist solely of rye, yeast, salt, and spring water or milk, without any addition whatever of chemicals, sugar, or the like. The rye grain must be of top quality, so that the maximum amounts of protein and tocopherols are obtained, together with a high percentage of vitality and enzyme activity.

Rye requirements

Wasa's foremost research chemist, Director David Karp, has carried out a great deal of valuable research on the rye grain and has contributed papers on this subject to many international scientific congresses in both Europe and America. His researches have shown that in order to obtain the maximum nutritional qualities in the crispbread, together with retention of flavour and a long shelf life, it is essential that in the whole rye grain the composition of the cereal fats should be as stable as possible. This fat stability occurs in the undamaged grain when the diastatic activity is low. The fat occurs mainly in the germ and the aleuronic layer that is anatomically bound to the germ, and these factors should be given special consideration during the cleaning and milling processes to ensure that the final product contains optimal properties.

Thus, during the cleaning processes, the husk should not be abraded with carborundum or similar substances, as this lays open the unsaturated fat in the aleuronic layer, resulting in a

(*Left*): **Automatic handling, cleaning and mixing of the grain.** (*Right*): **The specially constructed electric ovens, over 80 yards long.**

more rapid autoxidation, and also breaks off the germ tip so that this valuable portion of the grain, with its 13% fat content, is also quantitatively lost during the subsequent cleaning procedure. A gentle cleaning process consisting of washing and brushing is therefore used, and in subsequent milling the grain is cut to pieces so that the fat tissues remain intact as long as possible.

By this means the aleuronic layer tissues can be retained intact in the finished bread product, where they are also protected by the fat-soluble component, vitamin E. Anti-oxidants externally introduced into the fat particles of the dough or bread are inefficient, and the process itself is difficult. For these reasons the best method is to use only undamaged raw material containing high amounts of natural tocopherols, of which 7 mg.% is the maximum found in rye grain.

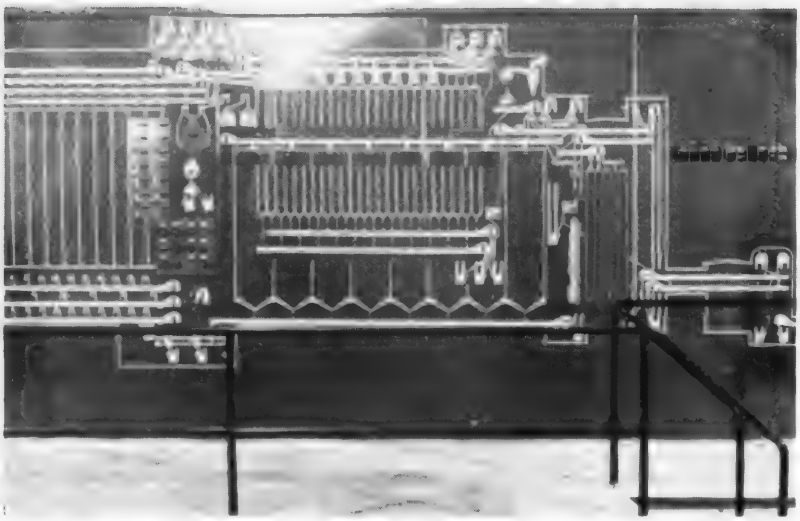
Buying the right grain for the crispbread manufacture is therefore of the utmost importance, and this task is supervised at Filipstad by Director Waldegren, with the assistance of sample-testing stations in all parts of the world, including South America, and at Kansas City in U.S.A. Occasionally the rye crops in Sweden may be adequate in quality and quantity to supply the needs of the factory for the whole year, as in 1955 and 1959, but this seldom occurs. Usually samples of crops from abroad are tested, and if the rye is of the required quality it is bought and shipped to Sweden, arriving finally in special railway trucks at the Wasa factory, which has its own railway station.

Automatic grain handling

No rye is allowed to enter the main silos without first control samples being tested at the laboratory. After unloading, the rye is first stored in the bins of the control silos until the analysis result is available. All handling of the grain, such as reception, cleaning, aeration and transport between the various silo plants and the mill is dealt with by one man. This man is posted in the top weighing hall located beneath the classification silos, where a large operating centre is established, at which he can supervise the 150 tons of grain that pass through the whole plant daily.

Panel indication

The operating centre is arranged in the form of a detailed mimic diagram combined with an operating desk. The left-hand panel shows diagramatically the 24 and 32 weighing scales which determine the mixing recipe for the grain, from the classification bins to the homogenising bins and from the storage bins to the mill. The transport mimic diagram indicates the passage of the grain from the control bin conveyor via elevators and redlers (horizontal conveyors) to the cleaning machine, and from thence by way of two big redlers to one of the 96 bins constituting the classification battery. The remote control equipment for this battery enables automatic feeding and distribution of grain according to a programme set in advance.



A section of the transport mimic diagram in the operating centre.

The 96 bins are divided into 12 groups of 8 bins. Each of the two redlers has its outlet for such a group which is divided into 2×4 cells. On the mimic diagram only the $12 \times 2 = 24$ sub-groups are included. A change valve is fitted with two outlets each connected to a rotary distributor with 4 positions. All the redler outlets in this battery and the change valves and rotary distributors are motor-driven, and the programme is set at the operating desk by various switches and cut-outs for blocking those bins not to be included in the programme.

To indicate the level of the bins in the battery, a level contact is built into the concrete wall and receives impulses as the bin fills. The level contact consists of a diaphragm which actuates a micro-switch. Thus it is possible to follow the actual grain level in all the 96 bins of the 24 groups, each group with 4 indicators in the vertical part of the operating desk.

Grain distribution

When the plant is started the grain stream comes to the first outlet on one of the redlers and runs via the change valve and the rotary distributor into the designated bin. When bin No. 1 is full the rotary distributor receives an impulse, and when bin No. 3 is full in a given group the change valve comes into operation. After a whole bin group has been filled the redler outlet of the distribution group is closed and the grain stream proceeds to the next group comprised in the programme, where the same procedure is repeated.

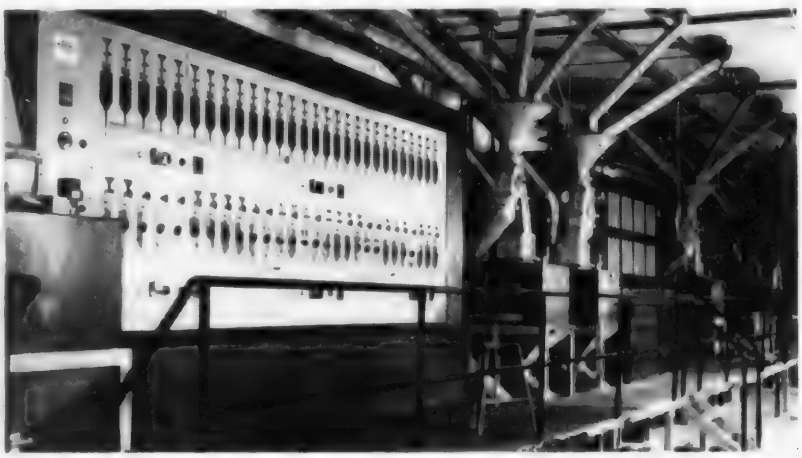
The grain then passes to the weighing hall, where automatic scales work on the principle of constant weight but varying emptying time, *i.e.* the weight is set at a constant figure and a capacity knob controls the time interval at which the weighing scale receives an emptying impulse, thus fixing the amount of a given component. There is also an electro-magnetic counter which records in kilograms the amount of grain passing over the scale.

The mixing of a batch for delivery to the homogenising silos requires only the setting of the capacity knobs which control the scales connected to the bin groups containing the required components for the mix. There is provision for an automatic stop at a given amount by setting a separate integrating counter which shuts off the mixing when required. In the event of an interruption, weighing lamps show the scale where the interruption has occurred.

Milling and dough mixing

The grain is ground to flour by roller mills, and to obtain the desired equal-sized meal particles the flour is sifted after a first grinding and all the correct-sized particles removed, then the remaining meal is ground again and re-sifted, this process being repeated until all the particles are the right size.

The dough mixing proceeds entirely automatically. Below the flour bin battery of 30 bins there are 15 dough mixers, one for each production line. Each mixer is fed from 3 high-speed automatic weighing scales with flour, yeast blended with water, and salt. The principle is, as elsewhere, constant weight with variable emptying frequency. Rapid coarse feeding



The operating centre for the silos, showing the mimic diagram in the foreground and the operating desk to the right.

followed by exact fine feeding is applied to ensure high accuracy.

Because there are more bread varieties than production lines it is necessary to be able to alter the recipes quickly by changing the weight setting on the scales. Milk, when required, is added automatically at constant intervals from a tank supply which gives an alarm signal when empty. Change of tank is carried out easily by remote control from the operating desk. In this way one man can supervise 4 dough mixers, which produce over 3,500 lb. of dough per hour.

Baking

The dough, after leavening, is shaped by machinery into square semi-fabricates, and after proving for about half an hour the squares pass forward on moving bands into the huge electric ovens, each over 81 yards in length. The speed of the moving band is adjusted so that the time taken by the dough squares to pass along the whole length of the oven is the exact period required for baking, *i.e.* from 5 to 10 minutes according to the variety of bread. During baking the oven temperatures reach a maximum of 102°C. When the baked bread emerges from the oven it passes up by moving band to the next floor, where it is stacked to dry for 5 to 6 hours.

The sorting and dividing into portions of the bread was formerly done by manually turning and taking out or laying together, but with the modern demand that the product shall be untouched by hand the bread sheets are turned by automatic machinery in front of the scrutinising eyes of the woman sorter, after which the portions are automatically arranged together for subsequent sawing and packing. Defective breads of poor appearance are directed to the waste pile by pressure on a button. Such faults can also be detected by photocells, but it is considered that the human eye is still the safest way for sorting.

In the large packing hall there are numbers of automatic machines for sawing up the bread sheets into one-foot squares for the kilo packets and small slices for the quarter-kilo packs. The problem of the large amount of bread dust from these machines has been solved by the insertion of suction pipes and filters above and below the saws, and these suck up the bread particles so efficiently that the atmosphere in the packing-room remains clean and unaffected, regardless of the large amount of sawing which takes place daily.

Packed cartons of crispbread being stacked by clamp-truck. The system of chute and conveyors which bring the cartons to the stacking point can be clearly seen.

Automatic packing

The sawn slices are packed by automatic machinery in waxed paper, those for export being given a double, specially prepared wrapping paper for extra protection. At the end of the production lines are metal detectors through which every completed packet must pass. The detector is so sensitive that even a tiny metal pin-head can alter the electric field sufficiently to work a relay which causes the offending packet to be thrown out to an examination table, whilst at the same time a warning signal is given to the operator.

The approved packets are collected and placed by machinery into strong cardboard cartons, which then proceed by chute to the distribution hall below. Small electric trucks transport each load of about 50 cartons to an automatic tipping platform, below which the delivery van or railway container stands, so that the entire loading procedure takes place under cover.

Wasa factory has its own railway station and an excellent system of communication with its main markets in Sweden and the ports of Stockholm and Gothenburg for export. It also has a fleet of 85 large delivery vans which drive to all parts of the country.

Since automation, safety in the factory has increased and the number of accidents whilst at work

(*Concluded on p. 536*)

Part of the laboratory where a large number of routine daily tests are carried out.

Toughness in Meat

By Fergus Hill*

Both ante and post mortem factors play a part in the degree of toughness of a meat cut as it reaches the eater. This subject is still far from being completely understood, but the following review surveys our present knowledge of these factors and describes methods of measuring toughness.

CONSUMER preferences show a demand for tender meats. The factors mentioned in the literature as being associated with toughness (lack of tenderness) in meat may be broadly classified as *ante* and *post mortem*. Among the *ante mortem* factors are: the amount and kind of connective tissue, the size of the muscle bundles, the diameter of the muscle fibres, the species of animal, the intramuscular fat (marbling) content, chronological age, sex, heredity and the degree of activity which various muscles have undergone.

The *post mortem* factors of importance are: *post mortem* age and *post mortem* intramuscular biochemical reactions, the degree of hydration of the muscle proteins and cooking methods.

The sensation of toughness in meat may be resolved into at least three components: the ease with which the teeth sink into the meat when chewing begins; the friability or ease with which the meat breaks into small fragments in the mouth; and the quantity of residue which remains after chewing. Friability may be an index of the resistance to rupture of muscle fibre perpendicular to its axis. The amount of residue may be a measure of the quantity of connective tissue present. This review outlines methods which have been used to measure toughness and discusses the various associative factors mentioned above.

MEASUREMENT OF TOUGHNESS

Both subjective and objective methods have been used to measure toughness. Sensory panels are used in the subjective assessment but as meat has a non-uniform texture, even within a single muscle, large samples are required for each member; this limits the size of the panel and consequently the accuracy.

Another difficulty with panel work is that it is not possible to supply reproducible reference samples. When tests are carried out over a period each member of the panel is obliged to memorise a rating scale of tenderness.

A partly subjective, partly objective, method to compare the tenderness of different meat samples is to count the number of chews required to masticate the sample to a determined end point. Samples of the same size should be used and they should be prepared so that the fibres are a definite length in all samples. The end point of mastication of the sample is taken at the stage in the chewing process at which the sample would normally be swallowed and a score point is allotted to, say, every 15, 20 or 25 chews. There is scope for investigational work on the factors which may influence the judgment of panel members.

Objective methods

Objective methods of measuring toughness are designed with a view to overcoming the difficulties inherent in subjective assessments. The process of eating meat involves the operations of cutting, tearing and squeezing. Many of the mechanical devices which have been designed to measure toughness aim at imitating the action of the mouth when a piece of meat is being eaten. Lehman[1], cited by Bate-Smith,[2] in 1907 used two devices to measure toughness, one determined the breaking strength of the meat, the other determined the force required to shear it.

Shearing machine

The Warner Bratzler[3, 4, 5] shear machine referred to by Shultz[6] is the most widely used device for measuring toughness. It was designed in the U.S.A. over the period 1928-32. It consists of a steel blade about 1 mm. thick, through which is drilled a triangular hole slightly larger than the sample to be tested. The cutting edges of the hole are smoothed to a standard dullness. The core of meat (1⅛ in. in diameter) to be tested is placed in the hole in the blade so that the grain is at right angles to the cutting surface during the shearing of the meat. Two shear bars are then pulled downwards by a motor. The meat is pressed so tightly into the triangular shaped knife that it is sheared. When the instrument is in operation the load on the meat builds up to a maximum and the fracture of the sample is sudden and complete. The maximum force in pounds during shearing is recorded on a dial dynamometer. This is taken as a measure of toughness.

Hurwicz and Tischler[7] showed that some of the variations observed in the Warner Bratzler shearing method could be ascribed to the apparatus. They found that the measurement of the slope of the force time curve gave a smaller coefficient of variation (4·79%) than that of the maximum shear force (7·41%). The Warner Bratzler shear values correlate satisfactorily with sensory panel evaluations of heated samples.

Penetrating instruments

Attempts to shear raw meat are usually ineffective. Tressler, Birdseye and Murray[8] in 1932 de-

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signed an instrument which determined the pressure required to push a metal rod 2½ in. long and 5/16 in. in diameter into a piece of meat. The puncturing end was symmetrically tapered to a core about ⅜ in. in height. The point had a radius of about 0·08 in. The instrument was called the cutting gauge and was used on samples of meat occupying 3 sq. in. and having a thickness of 1 in. Eight readings of pressure were taken on each sample.

In the same paper the authors describe a penetrometer. A needle 1⅜ in. long and 0·15 in. in diameter and having a rounded point with a radius of 0·07 in. was placed in a vertical position over the meat sample. A 255 g. weight was then placed on top of the needle and held for exactly 15 seconds, at which time a reading of the penetration in millimetres was recorded on a dial geared to the movement of the needle. Tressler and Murray[9] concluded that the penetrometer was more satisfactory than the cutting gauge.

Child and Sartorius[10] in 1938 used an instrument in which shearing bars were pulled across a blade containing a triangular opening. The sample was placed in the opening and as the shearing bars were pulled across the sample, the force required was recorded on a gauge.

"Bite" simulators

In 1938 Volodkevich[11] designed an instrument in which two blunt metal wedges or "teeth" were used to bite the sample of cooked meat. The sample was placed between the two wedges, one of which was stationary. The other wedge was moved mechanically through the sample. A continuous recording of the exertion of pressure on the sample was made on a revolving drum. The work done in cutting through the sample was interpreted in terms of the area under the load displacement curve.

Winkler[12] in 1939 used the same principle in his instrument and expressed the work done in unit thickness of the sample. Using the same principle Sale[13] has built an apparatus which he describes as follows: "The wedges are rounded to a radius of curvature which is easy to reproduce and such that they should not wear out of shape. A rectangular sectioned sample of meat is placed between the wedges, which have plates at each side to prevent the meat from being squashed out sideways. The force on the wedges is gradually increased and recorded together with their penetration until the wedges meet; the force is applied by drawing a steel ball along the beam which carries one wedge. A pen on the end of the beam records the penetration on a drum chart driven in step with the ball and so a force penetration curve is obtained. Normally the sample is cut so that the wedges bite across the fibres, as this gives the best correlation between toughness and the force needed to "bite" through the sample. Correlation would not be expected to be perfect as only the first bite in the mouth is simulated, but this force is a useful guide to toughness. Further, the shape of the force penetration curve distinguishes between "rubbery" meat and meat that breaks down easily in the mouth."

Tenderometer

A mechanical tenderometer based on the Volodkevich principle has been designed by Grunewald[14] and described by Shrimpton and Miller.[15] A sample of meat measuring about 2 × 1 × ½ cm. is placed between two "pressure ridges" on the instrument in such a way that the direction of the fibres is at right angles to the ridges. The pressure ridges are then made to "bite." As they do so some of the fibres are squeezed apart and others are sheared. Ultimately the sample is cleaved in two. A pen recorder attached to the instrument furnishes a trace of the rate of movement of the ridges and from the known constants of the instrument, the force used to cleave the muscle can be calculated. The force is also recorded on an arbitrary scale attached to the instrument. The area of the curve indicates the difficulty which the ridges experience in squeezing the muscle fibres apart as well as in shearing them. The area under the curve is proportional to the work done in cleaving the sample. Results can be corrected to a standard thickness of 0·5 cm. Because of the smallness of the sample required replication from the same muscle is easy.

Shear press

The Kramer shear press described by Kramer, Aamlid, Guyer and Rodgers[16] in 1951 uses hydraulic pressure to force a series of metal plungers downward through the sample held in a metal box. The press measures the maximum pressure required to force the plungers through the material. Shultz[6] has used the press on both cooked chicken and cooked beef.

In the latest form of this instrument, the Lee Kramer Comptroller electronic shear press, the mechanical energy of the shearing force is transformed into electrical energy. Shear resistance readings are obtained on graph paper in a recorder.

Miyada and Tappel[17] in 1956 modified the Christel Texturemeter by attaching an electric motor and reduction gears. A number of rods were pressed through cylindrical samples of meat. The total work and maximum shear force required were recorded at two second intervals. Work diagrams were obtained by plotting the recorded data in lb. of force as a function of distance measurements. From the crest of the force-distance diagrams maximum shear readings were read. The area under the curve represented the total work involved. Miyada and Tappel concluded that the instrument is more consistent than the Warner Bratzler machine.

Mincer

Miyada and Tappel[17] also used an electrically driven meat mincer to measure toughness. They wired the mincer motor in series with an

A.C. ammeter and recorded the ampere readings during mincing of the meat sample at five second intervals. A plot was made of these ampere readings as a function of time and the area under the resulting curve was obtained and converted into energy per unit weight of sample. The power consumption of the mincer during idling should be small compared to that during mincing. The authors found this method to be more consistent than the Warner Bratzler procedure.

Bockian, Anglemier and Sather,[18] using a trained sensory panel, measured the toughness of samples from the *longissimus dorsi* muscle of rib roasts. They compared the results of the panel with the results obtained by measuring the energy required to mince samples from the same muscle. The results from the mincer method were significantly correlated with those from the panel.

The highest correlation coefficients were obtained when the meat was minced and tasted immediately after preparation. Duplicate samples showed a 10% variation in the energy required.

Schoman, Bell and Ball[19] carried out tests to determine the causes of variation in the measurement of meat toughness using the meat mincer. They used 50 g. roasted samples. The principal causes were found to be due to changes in the motor temperature, fluctuations of the line voltage and the variable friction of the rotating mincer elements. The variations of the motor temperature caused a change in the power consumption of the motor. It was found that a warm-up period of 80 minutes was adequate to establish a constant temperature and therefore a uniform rate of power consumption. The line voltage fluctuations were effectively controlled by incorporating a constant voltage transformer in the power circuit. The variable friction of the rotating mincer elements was overcome by inserting a removable locating pin through the retaining ring, into the mincer head housing. This prevented excessive tightening of the ring which caused a variable friction between rotating parts. The average coefficient of variation obtained by the method was 5·57% compared with 19·4% in the Warner Bratzler shear method. The power consumption during the mincing was measured by a watt hour meter having an accuracy of 0·3%.

Denture tenderometer

Proctor, Malecki and Welch[20] in 1955 designed a recording strain gauge denture tenderometer. This apparatus consists of a pair of human dentures arranged to simulate the frequency and motions of chewing. Electrical strain gauges measure the biting forces, which are recorded throughout the chewing cycle by an oscillograph.

A later paper by Proctor, Davison and Brody[21] reported changes in the strain gauge denture tenderometer whereby force penetration diagrams could be obtained.

Requirements of measurement

Sperring, Platt and Hiner[22] state that present carcase grading systems do not accurately indicate tenderness. A device to measure meat toughness so that carcases could be certified as to their degree of toughness should both measure the tenderness of a sample of raw or cooked meat and should give results quickly and be easy to operate. With these aims in mind the authors designed a tenderness press. The press is a modification of the Carver juice press.

Meat samples $\frac{1}{2}$ in. thick are placed inside a cylinder and hydraulic pressure is applied by variable speed motor. The reading on the pressure gauge when the meat begins to extrude through a hole in the bottom of the cylinder is a measure of the toughness of the sample. Readings are in lb./sq. in.

The tenderness press measurement of beef samples cooked after 10 days ageing showed a highly significant correlation with a sensory panel evaluation. The tenderness press used to measure the tenderness of raw beef samples aged 3 days showed a highly significant correlation with the Warner Bratzler shear (0·785) and sensory panel ratings (0·899) of meat cooked after the customary ageing period of 10 days. This suggests that the tenderness press readings on an approximate 30 g. sample of meat aged 3 days could be used to estimate the tenderness of meat at the usual cooking time.

An instrument used for measuring toughness should correlate well with the results of sensory panels and should not merely determine reproducible differences of a property which is not known to be correlated with toughness. There is still scope for a study of present instruments and for the development of new ones. Bate Smith[2] says: "Even if mechanical devices are employed to measure certain physical properties related to tenderness, the results obtained by their use must be adjusted to the verdicts of human judges on the tenderness of the samples tested. Often this basic correlation is neglected by the promoters of a particular apparatus for measuring tenderness, or the data on which correlation between human judgment and the mechanical measurement is claimed are not reported in any detail."

ANTE MORTEM FACTORS

Connective tissue

The connective tissues associated with muscle are composed of collagen, elastin and reticulin. Hiner, Anderson and Fellers,[23] and Callow,[24] regard the connective tissue as playing a large role in determining the tenderness of beef.

Collagen is a tough, fibrous protein. On hydrolysis it yields a large amount of hydroxyproline. It contains polysaccharide material such as hexoses, chondroitin sulphate and hyaluronic acid. On prolonged boiling with water it forms a gelatin irreversibly. It is only slowly attacked by most dilute acids and bases. Enzymes appear to have little effect on it.

Shrimpton and Miller,[15] in reporting some causes of toughness in broilers, state that differences in toughness cannot be adequately

explained by differences in the total amounts of collagen present. They suggest that a better hypothesis would be one which also took account of the rate and pattern of growth. For example, apart from the problem of changes in the molecular configuration of collagen, one may consider the possibility that collagen is laid down uniformly when growth is continuous and only in zones when growth is intermittent.

Elastin which is present in large quantity in the *ligamentum nuchæ* is a protein and is yellow in colour. It is very elastic, unaffected by boiling water and is generally more resistant to attack than collagen.

Reticulin appears to be similar to collagen. Its behaviour in boiling water is unknown. Cruickshank and Hill,[25] cited by Whitaker,[26] have demonstrated that reticulin contains an antigen not present in collagen.

Hershberger, Deans, Kunkle, Gerlaugh and Deatherage[27] in 1951 reported contrary to the findings of earlier and later workers that there is no correlation between the amount of connective tissue and tenderness. There is good agreement in the literature that the increase in tenderness due to *post mortem* ageing is not due to changes in the connective tissue (Wierbicki, Kunkle and Cahill,[28] Wierbicki, Cahill, Kunkle, Klosterman and Deatherage,[29] and Ramsbottom and Strandine[30]).

Muscle bundle size

In 1937 Brady[31] reported that the number of muscle fibres making up a muscle bundle was related to tenderness. Sartorius and Child[32] in 1938 found that large bundles of fine fibres are more tender than smaller bundles of thick fibres. Hammond[33] in 1940 said that in his opinion the main factor affecting tenderness in meat is the size of the muscle bundles or the "grain" of the meat. "The meat from young animals is tender and that from old animals tough; in young animals the 'grain' of the meat is fine, whereas in old animals it is coarse. Increase in size of the muscle bundles with age is brought about by increase in muscle fibre size. Within any one joint such as a leg of mutton, some muscles such as the *gracilis*, with small muscle fibres and fine grain, are tender, and others such as the *vastus externus*, with large muscle fibres and coarse grain, are tough. The meat, too, from small animals in which the muscle bundles are small, such as the rabbit and sheep, is tender, whereas the meat from large animals in which muscle bundles are large, such as cattle, is tough."

Ramsbottom, Strandine and Konz[34] reported great variation in texture of muscles as determined by the size of the muscle bundles. Hiner, Hankins, Sloane, Fellers and Anderson[35] in 1953, in studies of 52 beef animals varying in age from 10-week-old calves to 9-year-old cows, reported that fibre diameter was associated with tenderness. The relationship was found to be curvilinear and the correlation was 0·83. Histological examination of the same muscles showed that the amount and distribution of collagen and elastin was associated with tenderness.

Lorincz and Biro[36] in 1960 found that muscles containing slender muscle cells tended to be tender. A relationship was also found between quantity of connective tissue and tenderness.

Intramuscular fat (marbling)

It has been widely accepted that the tenderness of beef increases with fatness. Cover, King and Butler[37] in 1958 measured separable fat in the 9-10-11 rib cut and determined the percentage ether extract of the trimmed ribeye in the 9-10-11 rib cut. Separable fat is a measure of fat deposition between the muscles and on the surface of the rib cut. Percentage ether extract may be regarded as a chemical measure of marbling.

Coefficients of correlation were calculated for tenderness rating with carcase grade, separable fat and ether extract. The coefficients were low and not consistent as to sign. Other workers (Hankins and Ellis,[38] Wellington and Stouffer)[39] have also published results which suggest that marbling is not an infallible indicator of tenderness.

Chronological age and sex

Hiner and Hankins[10] determined the tenderness of nine samples of beef muscle representing the principal cuts. A total of 52 animals were used: eight $5\frac{1}{2}$-year-old cows, eight 3-year-old barren heifers, twenty-five 900-lb. steers, eight 500-lb. steer calves, and three 10-week-old veal calves.

Using the Warner Bratzler machine it was found that the samples from each of the five age groups could be resolved into four groups of increasing tenderness as follows: (1) the neck and foreshank; (2) the round; (3) the chuck at the third rib and across the humerus bone, the eighth rib, the short-loin and loin end; and (4) the tenderloin.

Less difference in tenderness was found between samples representing veal or 500-lb. steer calves than in those from older and more mature animals. Correlation coefficients showed no close relationship between different samples within the same age group with respect to tenderness.

As the age of the animals increased, tenderness decreased for each of the nine samples. The difference between veal and cows was highly significant, whereas that between veal and beef from 500-lb. steer calves was not. Wierbicki *et al*,[29] from their studies on cattle, state that the sex of the animal appears to be less important than age in indicating tender beef.

Heredity

Observations by several workers lend support to the hypothesis that the heredity of the animal influences the tenderness of meat. Black, Semple and Lach[41] reported that the roasted meat of Brahman Shorthorns was less tender than that of Herefords or Shorthorns. The wide variations observed among individual animals in the different groups were thought by the authors to indicate "possibilities for improvement

which selection and breeding methods now offer to the energetic worker in the field."

Hostetler, Foster and Hankins[42] found a highly significant difference between tenderness in the progeny of a native bull mated to 48 native cows and a grade Hereford bull mated to 46 native cows. Hiner and Yao[43] stated that heritability coefficients estimated by the half sib method showed that when the high level of heritability is set at 40%, factors such as the size of the ribeye, length and width of the ribeye, intensity of marbling, quality of juice and resistance to shearing may be effectively selected.

Cartwright, Cover and Butler[44] determined the heritability of tenderness for 5 Hereford and 6 Brahman sires, using steaks from the loins and bottom rounds of 49 steers. The work indicated that the heritability of certain eating quality characteristics may be sufficiently great to allow selection.

Means[45] found that a heritability estimate for tenderness indicated that by selecting sires of tender progeny some progress could be made in breeding for tender beef.

Degree of muscular activity

It is well known that the muscles which are exercised the most tend to be the toughest and those which are exercised least (*e.g.* the tenderloin) tend to be tender. In this connection the work of Helander[46] is interesting.

He concluded from his work on guinea pigs and rabbits that skeletal muscles adapt themselves to the degree of functional activity, not only by showing hypertrophy after exercise and hypotrophy after restricted activity but also by alterations in the composition of the muscle cells.

Exercise thus enhances the myofilamental density in the muscle cell, whereas restricted activity reduces the myofilamental density and instead increases the sarcoplasmic content. Both these processes are liable to influence the contractile strength of the muscular tissue.

POST MORTEM FACTORS

Post mortem age and biochemical reactions

In the period of time which elapses between death and the onset of *rigor mortis* the muscles show a decrease in glycogen, *p*H, adenosine triphosphate, creatine phosphate and an increase in lactic acid, ammonia and breakdown products of adenosine triphosphate. Eventually actomyosin is formed. During this time the muscles become very hard, inflexible and contracted. If the carcase is "aged" for a few days the muscles again become soft, pliable, relaxed and tender. Unfortunately the chemical changes which take place in muscle during this resolution of *rigor mortis* have not been elucidated. Obviously they are of great importance in connection with toughness.

Degree of hydration of muscle proteins

Wierbicki and Deatherage,[47] working at the Ohio State University during the last decade, have concluded from their results that such factors as tenderness, texture, drip on freezing and thawing and shrinkage on cooking are all related to the degree of hydration of the muscle proteins. They state that the highly polar water molecules are attracted to the muscle proteins by ionisable basic and acidic groups such as occur in arginine, histidine, lysine, glutamic and aspartic acids, or by polar non-ionic groups such as occur in cystine, cysteine, serine, methionine, threonine, tyrosine and tryptophane. In addition to electrostatically bound water, muscle also contains physically absorbed water, held on the proteins by secondary forces, such as water dipole-dipole induction, hydrogen bonds and capillary and surface attractions.

Wierbicki, Kunkle, Cahill and Deatherage[48] found that both *p*H and the juice expressed on cooking changed with the *post mortem* age and appeared to be interrelated. The change in juice expressed on cooking was found to change simultaneously with *p*H in an inverse relationship. The *p*H affects the water-holding capacity of the meat by altering the charges on the proteins. An increase in *p*H would result in an increase in the charge on the protein and hence a better water retention capacity. A large quantity of potassium ions are absorbed by the myofibrillar proteins during *post mortem* ageing, and sodium calcium and magnesium ions are released. The accumulation of potassium ions increases the net charge on the meat proteins, allowing greater hydration. Wierbicki, Kunkle and Deatherage[49] found that the addition of the chlorides of sodium, potassium, magnesium or calcium increase the water-holding capacity of beef protein on cooking and on freezing and thawing. They concluded that a combination of sodium and magnesium chlorides showed the greatest promise in promoting the water-holding capacity of cooked beef and that beef could be made more tender by treating with a solution of these chlorides.

Cooking methods

During the cooking of meat two major changes occur; the muscle fibres become tougher and the connective tissue becomes more tender. Cover and Hostetler[50] have examined the conditions of cooking of beef such as temperature, time and kind of cooking medium. Their results indicate that different cuts do not respond alike to any one set of cooking conditions. If grilled rare a loin steak may be tender but a bottom round steak will be tough. If both cuts are braised very well done the bottom round steak becomes tender and the loin steak tough. The basis for this difference does not lie in the different amounts of connective tissue in both cuts because the braising has hydrolised all the collagen present. It would appear that the muscle fibres in loin steaks appear to be toughened by heat much more than those of bottom round steaks. The muscle fibres of the two cuts differ in some inherent manner which is not clear at present. Shear force values indicated that loin steaks became tougher as they were

cooked thoroughly. Apparently by the time a steak temperature of 80°C. was reached, toughening had already taken place and no tendering of loin steak occurred at higher temperatures.

The ideal aim in cooking should be to effect a balance between the extent to which the connective tissue is softened and the degree to which the muscle fibres are toughened. Thus, for muscles or cuts such as the round which are rich in connective tissue, the toughening of fibres is less important than the solubilising of the connective tissue, and cooking methods involving a long heating period and a moist atmosphere are selected. Muscles or cuts such as loin or rib which contain only small amounts of connective tissue are best cooked by methods involving dry heat for a short time. This minimises the toughening effect on the muscle fibres.

In this connection it should be pointed out that for cooking media such as water or steam (moist heat) the rate of heat penetration is high. For air the rate of heat penetration is low.

The work of Hamm and Deatherage[51] on the changes which take place in beef during heating is interesting. Between 20-30°C. no marked change takes place in the muscle protein. Between 30-40°C. a mild denaturation occurs resulting in the unfolding of protein chains and in the formation of new salt and/or hydrogen bonds. A strong denaturing starts at 40°C. and continues to 50°C. resulting in the formation of new stable cross linkages which are not removed by adding acid or base. The number of negatively charged groups of the muscle proteins decreases with increasing temperature. Between 50 and 55°C. the denaturation and the formation of new cross linkages are continued, but the decrease in acidic groups is delayed. By heating at temperatures above 55°C. the negatively charged groups decrease again. At about 65°C. the denaturation is almost but not completely finished.

Conclusion

In conclusion it may be stated that at present we do not know all the actual chemical individuals which are the direct cause of making meat tough. Application of Helander's technique[52] for the separate determination of myofilamental proteins and of sarcoplasmic proteins might yield useful information on telling whether the larger sarcoplasmic protein molecules actually pass into the myofibrils and hence render the muscle tough. It appears from Helander's work[46] that the com-

(*Concluded on p.* 528)

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Freezing Crabs Afloat

By C. V. Tench

Quick-freezing within minutes of catching is the secret of the rapid rise to popularity of Alaska King Crab. This article describes how the shellfish are processed on board a factory trawler.

IN the past several years frozen Alaska King Crab has risen from nowhere to a position of top popularity in the frozen food cabinet. The success of this somewhat exotic product of the sea has been due largely to the efforts of Captain Lowell Wakefield, president of Wakefield's Deep Sea Trawlers, Inc., supplier of a major share of the King Crab on the market.

Shortly after the last war, Captain Wakefield formed his company and had a specially designed, 140-ft. trawler built. This ship, named the *Deep Sea*, was outfitted as a processing and freezing plant, with zero storage space equalling that of eleven refrigerator cars. In the years since Wakefield's began taking its harvest from the sea in this ship—said to be the costliest fishing vessel ever to fly the American flag—the operation has expanded to five company-owned vessels and twenty-five trawlers under contract to Wakefie'd.

While the freezing and fishing operation was successful from the first, the market was slow to develop. For about three years, Captain Wakefield was faced with a struggle to create demand for the meat from this giant crab. But by 1950 the market began to respond, particularly in the restaurant area, and by 1953 the demand was so great as to threaten to exceed supply.

Faced with the necessity to provide his hard-earned market with a steady year-round supply of the crab meat, Captain Wakefield decided to risk a winter voyage into the Bering Sea. Previously, the ship had remained in port during January and February. The venture was considered impossible by many, but the *Deep Sea* weathered a five-day gale and ended up by packing to maximum capacity the King Crab legs and claws. Thus a constant supply was assured.

To capture the Alaska King Crabs, huge nets are dragged slowly over the ocean floor at three hundred feet or more. The waters where they are found were once great whaling spots, and occasionally a whale is picked up in a net—with the result that one specially designed and expensive Irish hemp net is ruined. These

Captain Lowell Wakefield, pioneer in the quick-freezing afloat of Alaska King Crab.

The cooking area on board the "Deep Sea" where crab meat is cooked in boiling sea water for 18-25 minutes.

nets, made according to a pattern developed by Captain Wakefield, permit small fish and female crabs (which are smaller than adult males) to escape.

From the nets, the crabs are dumped into "live" tanks of circulating sea water on deck. Because the pressure of the water in these tanks is lighter than that of the depths of the ocean, and the water is not so icy cold, the crabs become somewhat sluggish and more manageable. They are sorted on deck, and young male crabs and all female crabs are immediately returned to the sea

The specially designed 140 ft. factory trawler " Deep Sea " which hauls the King Crabs from depths of up to 100 fathoms and freezes them on board.

alive. Only the prime male crabs are kept.

Processing of crabs

These are butchered on a fixed, machete-like blade which knocks legs and claws loose. The rest of the crab is sluiced overboard. Legs and claws are washed, placed in wire baskets and lowered into stainless-steel tanks of boiling sea water where they are cooked. Crabs are cooked for eighteen to twenty-five minutes, depending on size and age.

The claws and legs then are chilled, washed again and trimmed. After careful inspection, they are wrapped in foil for extra protection, frozen, and packed whole in cartons. Later, many of the legs are cut in serving-size pieces and packed for the restaurant and consumer trade.

To produce the crab meat pack, legs are taken from the chiller and the meat is forced cleanly out of the shell in one piece by means of a pressure sea-water blower that leaves cartilage in the shell, removing the delicate meat—which is delicious eating—without damaging it.

After another washing, the meat is run over a long, stainless-steel conveyor where a crew pick out any stray bits of shell.

At the end of the conveyor line, a packing crew weighs out the meat in stainless-steel pans, forming 15-lb. blocks which are quick-frozen at $-25°F$. All packs are stored at $0°F$.

The *Deep Sea* can handle 3,000-3,500 crabs a day and process about 10,000 lb. of meat. Her freezer storage space accommodates 170 tons of crab.

(*Left*): **Crabmeat is run over a long stainless steel conveyor where stray pieces of shell are picked out.** (*Right*): **At the end of the conveyor line, the meat is weighed in stainless steel pans, forming 15-lb. blocks which are quick-frozen at $-25°F$.**

(*Left*): **Aboard the "Deep Sea," netted Alaska King Crabs are dumped into circulating sea water before they are processed and frozen on board.** (*Right*): **A prize-winning crab is held aloft by Thor, the cook. Fishermen are given a bonus of $50 for every crab measuring over six feet.**

The entire process, from ocean to deep freeze, takes less than sixty minutes. The process does not change the moist tenderness and delicate flavour characteristic of Alaska King Crab. No other type of crab freezes so successfully, and many prefer the fresh-frozen product to the fresh-cooked crab before freezing.

All Wakefield ships and shore-based plants operate under inspection by, and certificate from, the Alaska Department of Health. In addition, Wakefield's has its own laboratory with qualified technicians in charge operating on the fishing grounds. It is claimed to be the only sea-food operation in Alaska with its own on-the-spot quality control and product improvement laboratory.

The frozen King Crab goes from the ship to a packaging line at Bellingham, Washington, where it receives another final quality check. Here the large frozen blocks of crab meat are cut to size for retail and commercial trade and packaged for shipment.

Retail units are packages of 6-oz. solidly frozen blocks of crab meat cut from the *Deep Sea's* 15-lb. blocks, and 12-oz. packages of split legs.

The institutional trade gets 1, 2½ and 5-lb. blocks of crab meat, and 10 and 25-lb. boxes of legs and claws in the shell. Frozen whole legs are also sold by the pound through some retail outlets.

Correspondence

Advantages of joining the Food Group

SIR,

May I draw the attention of your readers to the advantages of joining the Food Group of the Society of Chemical Industry?

There is a belief in some quarters that it is necessary to have a scientific qualification to join the Society, but this is not so. Anyone having a serious interest in the technical side of the food industry will be welcomed into membership. While the primary interests of the Food Group are chemical, considerable attention is given to the technological, economic and legal aspects. The subscription to the Society is quite modest, and membership of all groups, with the exception of the Chemical Engineering Group, is free.

The Food Group is the largest, and holds meetings regularly from September to June, mostly in London but also elsewhere. Subjects for this year's programme include cereals, blackcurrant juice, meat flavour, low salt foods, apples, sugar, microbiological control, low carbohydrate foods, pork, gastronomy, foods low in gluten and in phenylalanine, and food technology in other countries. A special feature of the Group is the annual foreign tour, when we visit factories in various European countries. This tour and the annual conversazione afford opportunities for members to get to know each other personally.

The Agriculture, Microbiology, Industrial Water, Chemical Engineering and other groups frequently hold meetings of interest to food technologists.

Information about the Society and application forms can be obtained from the Secretary, Society of Chemical Industry, 14, Belgrave Square, London, S.W.1. I shall be pleased personally to give assistance to anyone wishing to join the Society.

J. G. DAVIS,
Chairman, S.C.I. Food Group,
London, W.1.

Calculating the Keeping Quality of Frozen Foods

By Mogens Jul*

One of the most comprehensive research programmes yet undertaken in the field of food preservation is the Time-Temperature Tolerance Project, the so-called TTT programme, carried out by the Western Regional Research Laboratory of the U.S. Department of Agriculture. The results of these experiments have made it possible to calculate accurately the effects of various storage and handling practices for frozen foods. This article draws a few preliminary conclusions from the various reports regarding the TTT programme, among which is the desirability of establishing three grades of frozen food—those which keep well at all temperatures, those which keep well at low but which are sensitive to high temperatures, and those with low keeping quality at all temperatures. This could mean different storage and handling procedures for these three grades.

IN most of the TTT programme carefully controlled organoleptic testing was used. As described by Guadagni (1957),[3] this was carried out in the main as triangle tests in which about 75% correct answers were required, which gives a high degree of probability. Samples stored at −29°C. or lower were generally used as controls. Several objective tests were also employed and showed very satisfactory correlation with the subjective tests, as indicated, for instance, by Boggs *et al.* (1960)[4] for frozen peas.

The latter study included tests on ascorbic acid content and showed that the first detectable organoleptic change correlated with a storage loss of 15 mg. ascorbic acid per kg.

The TTT project covered a wide range of the frozen fruit, vegetable and poultry products that are produced commercially in the U.S.A. For the purpose of this study, some figures for meat and fish given by Tressler and Evers (1957)[26] are also included.

Keeping quality curves

With the aid of the material referred to above Figs. 1 and 2 were drawn. It seems reasonable to assume that these curves will be adequate for the present purpose. They show the time required at

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Table 1. Contribution of each Stage of Temperature History to Deterioration for Severe Conditions Affecting not more than 5% of Products

	Warehouse	Break-up	Transport	Backroom	Cabinet	Total
Beef	1·64	0·134	0·016	0·167	0·184	2·141
Pork	2·70	0·227	0·023	0·249	0·267	3·466
Pork sausage	5·39	0·379	0·038	0·422	0·442	6·674
Fresh chicken	0·91	0·070	0·008	0·062	0·085	1·138
Fried chicken	12·05	0·859	0·086	0·929	0·998	14·922
Prepared turkey dish ...	2·70	0·192	0·026	0·292	0·266	3·477
Lean fish	1·64	0·099	0·009	0·101	0·124	1·976
Fatty fish	2·66	0·162	0·015	0·167	0·185	3·189
Strawberries	4·48	0·913	0·154	1·225	1·422	8·194
Peas	3·10	0·358	0·050	0·477	0·495	4·480

Table 2. Contribution of each Stage of Temperature History to Deterioration for Products under Average Conditions

	Warehouse	Break-up	Transport	Backroom	Cabinet	Total
Beef	0·365	0·018	0·002	0·027	0·021	0·433
Pork	0·639	0·032	0·004	0·042	0·040	0·757
Pork sausage	1·369	0·067	0·007	0·091	0·076	1·610
Fresh chicken meat ...	0·237	0·010	0·001	0·015	0·010	0·273
Fried chicken meat ...	2·65	0·134	0·014	0·180	0·150	3·128
Prepared turkey dish ...	0·549	0·031	0·004	0·043	0·035	0·661
Lean fish	0·550	0·026	0·002	0·029	0·027	0·634
Fatty fish	0·875	0·037	0·004	0·050	0·042	1·008
Strawberries	0·402	0·032	0·006	0·068	0·043	0·551
Peas	0·510	0·028	0·004	0·048	0·031	0·621

Table 3. Maximum Time and Temperature Limits for Frozen Foods (temperatures in °C.)

Product	Warehouse		Retail		Maximum at any stage*
	Temp.	Time	Temp.	Time	
Beef	−18	No limit	−12	2 months	− 4
Pork	−25	„ „	−15	2 „	− 4
Pork sausages	−30	„ „	−15	1 „	− 7
	(−25)	(6 months)			
Poultry	−15	No limit	−12	No limit	− 3
Pre-cooked poultry flesh	−30	„ „	−20	1 month	−10
	(−25)	(6 months)			
Lean fish	−20	No limit	−12	2 „	− 4
Fatty fish	−30	„ „	−15	2 „	− 7
	(−25)	(6 months)			
Peaches	−20	No limit	−15	2 „	−10
Strawberries	−20	„ „	−15	1 „	−12

* Not more than 24 hours.

various temperatures to produce a degree of change that will be discovered with a high degree of probability by a taste panel or an industrial expert panel.

The curves generally appear to be logarithmic when the logarithm for the time is plotted against temperature. This is not true for the figures given by Tressler and Evers (1957)[26] for beef and pork, but this may be due to the limited experimental results on which these curves are based.

For the purpose of the present consideration, the shape of the curves is not decisive.

The curves appear to be reliable from about the freezing point of the products to about −18°C. They are likely to be reliable at even lower temperatures.

Effects of treatment is cumulative

The experimental material from the TTT programme makes it reasonable to base calculations on the assumption that effects of storage at various temperatures are strictly additive, irrespective of the order in which they occur. Thus, Dietrich *et al.* (1959)[6, 7] studied the effect of varied sequences of storage at −17·8°C., −12·2°C., and −6·7°C. in an experiment covering about 13,000 individual packages of frozen beans. The conclusion was that whether the high temperature came first, last, or was interrupted by the lower temperature storage, the total deterioration was about the same when evaluated by flavour and colour judgments or measured by a certain loss in chlorophyll or ascorbic acid.

Similarly, Boggs *et al.* (1960)[4] found for frozen peas the same flavour and colour changes measured subjectively and the same changes in chlorophyll, ascorbic acid and colour, measured objectively, after the following treatments:

(*a*) 4 months at −12·2°C. followed by 4 months at −17·8°C.
(*b*) 4 months at −17·8°C. followed by 4 months at −12·2°C.
(*c*) 2 months at −12·2°C. followed by 4 months at −17·8°C. and then another 2 months at −12·2°C.

They also found that the effect of regularly fluctuating temperatures was nearly the same as that which would result from storage for the same period at the equivalent steady temperature, the latter being calculated by the formulas of Schwimmer *et al.* (1955).[25] This was true for the 24-hour sine-wave cycle over the following temperature range: −20·6°C. to −15·0°C.; −23·3°C. to −12·2°C.; and −17·8°C. to −6·7°C. They also exposed frozen peas to temperature patterns simulating commercial practice in handling and distribution; from these data they calculated the number of days at −17·8°C. that would result in the same deterioration and found remarkable agreement with the results of storage tests.

Guadagni *et al.* (1957)[10] found that for strawberries frozen with sugar the following treatments gave identical results in flavour change and in ascorbic acid losses.

(*a*) 6 days at −6·7°C. followed by 3 months at −17·8°C.
3 months at −17·8°C. followed by 6 days at −6·7°C.
(*b*) 6 days at −6·7°C. followed by 1 year at −17·8°C.
1 year at −17·8°C. followed by 6 days at −6·7°C.
(*c*) 12 days at −6·7°C. followed by 1 year at −17·8°C.
1 year at −17·8°C. followed by 12 days at −6·7°C.
6 days at −6·7°C. followed by one year at −17·8°C. and then another 6 days at −6·7°C.

They also found that regularly fluctuating temperatures resulted in changes that were not significantly different from those that would be expected at the equivalent steady temperatures.

Hanson and Fletcher (1958)[16] stored frozen turkey dinners and turkey pies at −6·7°C. for ½, 1, and 1½ months followed by storage at −12·2°C. for three months and compared them with samples exposed to the same conditions in reverse order. No flavour difference nor difference in peroxide value were found between corresponding samples.

Guadagni *et al.* (1957)[13] showed for peaches in sugar syrup that even when above freezing temperatures were included in the temperature history of the product, the deteriorative effect of various temperature periods was cumulative. They found no specific effects from cyclic fluctuating temperature other than those that were to be expected from the temperature history.

McColloch *et al.* (1957)[22] concluded after a very exhaustive investigation that the effects of time-temperature treatments on flavour in orange juice concentrates are strictly cumulative, even when above 0°C. temperatures are included.

Guadagni *et al.* (1958)[11, 14, 15] showed that the effect of fluctuating temperatures on frozen strawberries and raspberries was the same as that obtained by the corresponding constant temperatures.

Tressler and Evers (1957)[26] quote many instances where fluctuating temperatures *per se* have had no other effect than that which would be expected from the temperature history of the product.

Exceptions from Rule of Additivity

There are some cases where the total effect of various temperature experiences may not be independent of the order in which they occur.

Thus very widely fluctuating temperatures may cause in-package desiccation of a product. Klose *et al.* (1955)[20] found for turkeys in polyethylene bags that the frost formed in the bag was 0·33% for one year's storage at temperatures fluctuating from −23·3°C. to −12·2°C. over a 24-hour period. At constant temperatures the corresponding losses were as follows: at −23·3°C. about 0·07%; at −17·8°C. about 0·97%; at −12·2°C. about 0·20%.

Several foods with a high content of solubles, *i.e.* fruits frozen with sugar, ice cream, etc., have a low freezing point. It is not clear if passage or at least repeated passage of the freezing point may not cause some change that is not strictly cumulative. In some cases, however, the assump-

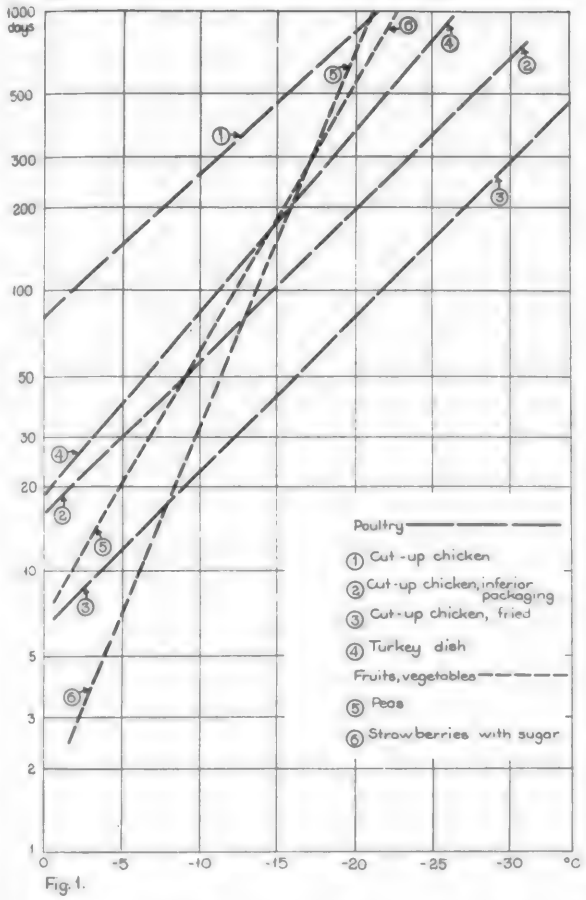

Fig. 1.

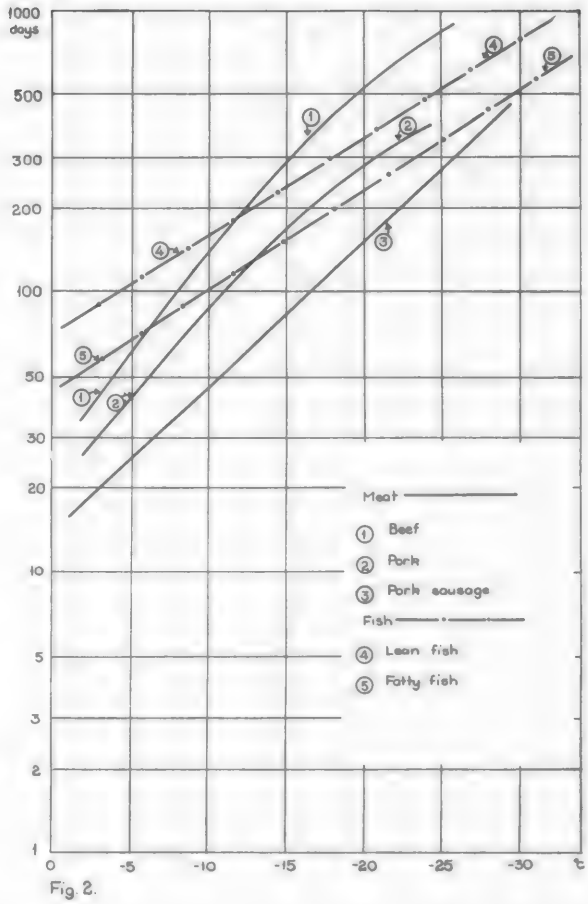

Fig. 2.

Figs. 1 and 2. Keeping quality curves for various foods showing the number of days necessary to produce a definitely detectable change plotted against the temperature of storage.

tion of the effect being additive is justified as indicated above.

Where the colloidal nature of a product is affected, the effect of time-temperature treatment may not be additive. Hansen *et al.* (1957)[17] found for the texture of starch-thickened white sauce and egg-thickened pudding that a fluctuating temperature, −23·3°C. to −12·2°C., was considerably more damaging than storage at the equivalent steady temperature, calculated according to the method suggested by van Arsdel and Guadagni (1959).[1] This is probably due to the discontinuous mechanism of the process.

When growth of micro-organisms occurs, the effect of time-temperature treatments may not be additive. Michener *et al.* (1960)[23] have shown that bacterial growth always takes place above −4°C. in frozen peas, beans, cauliflower, and spinach. Since no growth takes place below this temperature, this type of deterioration is not logarithmic over the range considered here. Off-flavours were detected, however, before the bacterial count had increased significantly. Therefore, this factor will hardly have any effect on the above mentioned additivity of the time-temperature treatments.

Calculating keeping quality

All the exceptions mentioned above refer to conditions which seldom effect the loss of quality of frozen products during storage. When they occur, they must be considered separately from any of the deterioration effects calculated below.

With the above reservations it appears reasonable to assume that the contributions of the various parts of the temperature history to the total storage change are additive. This, in fact, appears to be even better supported by experimental data than is the corresponding theory for heat processing of food cans.

Thus, it appears to be fully justified to proceed as van Arsdel and Guadagni (1959)[1] with a method similar to the so-called general method for calculating heat processes for canned foods, first suggested by Bigelow, *et al.* (1920).[3]

The keeping quality curves in Fig. 1 show, for each product and temperature, the number of days necessary to produce a change that is definitely detectable. The reciprocal value of the keeping time for a certain product at a

chosen temperature indicates the daily decrease in quality at this temperature. It is now convenient to design a graph paper, where the ordinate shows these reciprocal values, *i.e.* daily quality losses, together with the corresponding temperatures, and where the abscissa shows the number of days, *i.e.* the storage life of the frozen product. This type of graph paper has been used for Figs. 4 to 7. This is the procedure adopted by van Arsdel and Guadagni (1959).[1]

One may now enter any temperature history measured or assumed on this paper. The area below the line will correspond to the magnitude of storage change. Thus, if the area is 1, the products will have undergone a change that is easily detected in controlled organoleptic tests. If it is 0·5, the change will hardly be noticeable. If the area is 5, the product will definitely have changed. If many calculations are made, it may be convenient to prepare special keeping quality paper for curves such as those in Figs. 4 to 7. Results referring to one keeping quality curve can always be converted to another product having the same slope of its keeping quality curve.

Requirements

It appears reasonable to require that storage and handling should not have affected a product so much that it is definitely inferior to the well-stored product, *i.e.* the product stored at about −30°C. Thus, it would be desirable that the area below the temperature history curve be below 1.

Temperature histories

The exact temperature history to which each package will be exposed is not known beforehand. It appears reasonable to require that the products and equipment as well as handling and storage practices should be so that the product will not undergo a detectable change.

Since there will be a wide spread between the conditions to which the various packages will be exposed, it may be interesting to calculate the quality of such products according to conditions no more unfavourable than those which 95% of the packages can be expected to experience.

One may use the data from a study of Munter, Byrne and Dykstra (1953).[24] They examined a large number of facilities in the U.S.A. and plotted the temperatures found on probability paper. They also gave some indications of storage times.

From their data, conditions so unfavourable have been calculated that not more than 5% of the frozen food handled at each stage would be exposed to these or worse conditions. Obviously, the chances for the same package being exposed to these or worse conditions at all stages are very much smaller than 5%.

From the study referred to above one arrives at the following data regarding handling practices in the U.S.A. Not more than 5% of the frozen foods will be exposed to conditions that are less favourable than the following:

Maximum in warehouse: 8°F. (−13·3°C.) for one year
Maximum in break-up room: 20°F. (−6·7°C.) for 2 weeks
Maximum during delivery: 25°F. (−3·9°C.) for 24 hours
Backroom storage: 17°F. (−8·3°C.) for 2 weeks
Retail cabinet: 21°F. (−6·1°C.) for 2 weeks

Using this temperature history, the fate of the various products included in Figs. 4 to 7 has been drawn up on keeping quality paper and is reproduced in the figures.

It will be seen from the diagrams that this treatment is very severe for many products.

Therefore, the average conditions to which a frozen food package may be expected to be exposed in the U.S.A. was also calculated from the data given by Munter, Byrne and Dykstra (1953)[24] as follows:

Warehouse: 2·2°F. (−19·0°C.) in 6 months
Break-up room: 3·2°F. (−16·0°C.) in 1 week
Maximum during delivery: 10·4°F. (−12·0°C.) in 12 hours
Backroom storage: 5·0°F. (−15·0°C.) in 1 week
Retail cabinet: 3·2°F. (−16·0°C.) in 1 week

The effect of these treatments on the various products is also plotted in the figures.

The contributions of each period of the temperature history are summarised in Tables 1 and 2 (p. 520).

For comparison, in Fig 3 is also given the temperature distribution in the top layer of frozen foods in retail cabinets recently measured in Danish retail outlets.

Calculations of temperature requirements

The data in Figs. 3 to 7 and Tables 1 and 2 suggest that it may be useful to view existing or proposed regulations or specifications for storage and handling food in the light of the knowledge of the probable temperature history of the products and existing knowledge with regard to the keeping quality curves for the products.

One should probably consider establishment of several categories of foods. It appears that there are, in the main, three categories:

1. Products that keep well at all temperatures, *e.g.* raw chicken.

2. Products that keep well at low temperatures but are sensitive to high temperatures, *e.g.* fruit products in sugar.

3. Products with low keeping quality at all temperatures, *e.g.* prepared foods such as fried chicken.

In spite of the inconvenience it may cause to the trade, it might be useful to specify different storage and handling conditions for these products. Little has been done about this so far, but much along the same line is done, for instance, for refrigerated storage of fresh meats, cured meats, dairy products, etc. Canned meats, also, are prepared in such a way that different products have to be kept at different temperatures.

It is likely that any regulations or specifications set up for the storage and handling of frozen foods must include some reference to time of storage during the various stages of handling and to the type of

packaging. These factors are of great importance.

The data heretofore available may suggest the maximum time and temperature limits indicated in Table 3.

Djupfrysningsbyrân (1954)[8] recommends that all frozen food be stored at −25°C. (−13°F.) but will accept short time storage (1 month or less at −20°C. (−4°F.) and retail cabinets at −18°C. (−0·4°F.).

A Danish regulation, Landbrugsministeriet (1959),[21] requires that frozen pre-cooked dishes containing meat be maintained below −18° at all times and that they be stored at −20° or lower in warehouses.

AFDOUS (1960)[2] suggests that frozen foods should be stored at 0°F. (−17·8°C.). They should not be accepted by a retail outlet if the internal temperature exceeds 0°F. (−17·8°C.), and that temperature or lower should be main-

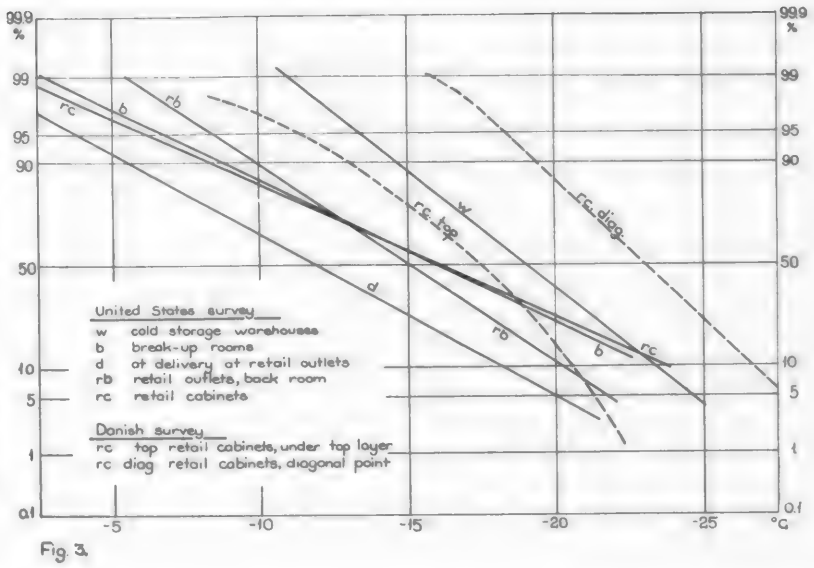

Fig. 3.

Fig. 3. Probability of encountering various temperatures in cold storage warehouses (w), break-up rooms (b), at delivery at retail outlets (d), in retail outlets, back room (rb), and in retail cabinets (rc) (Munter *et al.*, 1953). Corresponding figures from unpublished Danish survey of temperatures in retail cabinets under top layer of packages (rc top) and between packages at diagonal point (rc diag).

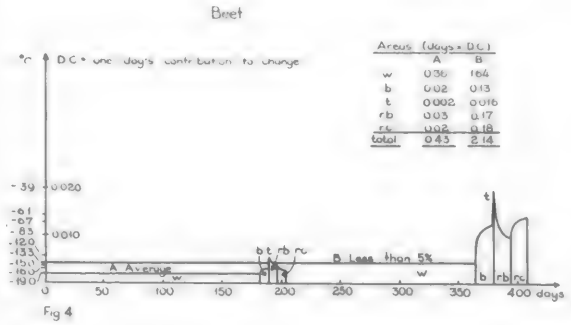

Fig 4

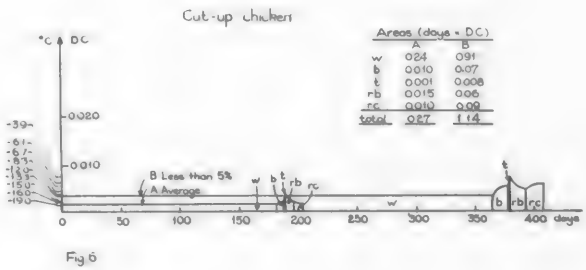

Fig 6

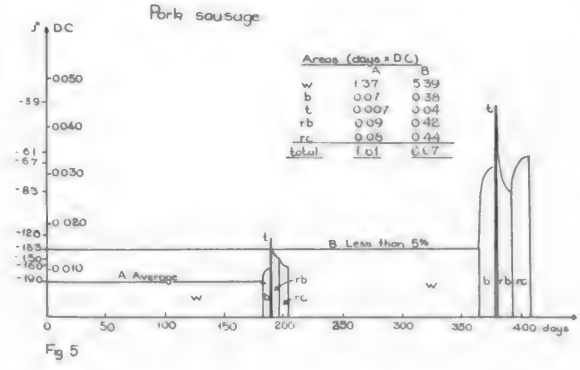

Fig 5

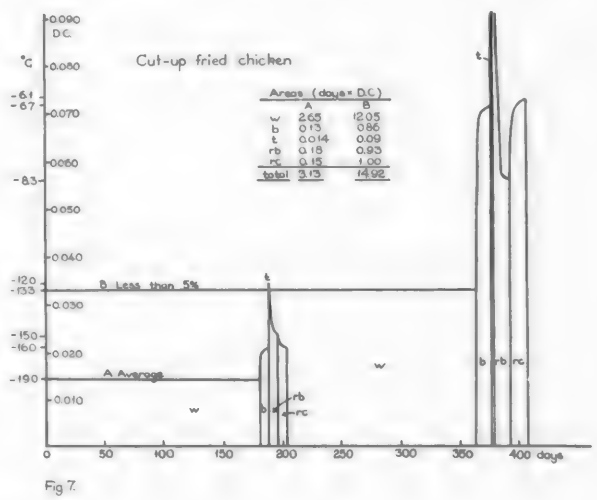

Fig 7

Figs. 4-7. Effect of average temperature history and of temperature history for not more than 5% of frozen beef, pork sausage, cut-up chicken and fried cut-up chicken. Areas indicate degree of quality deterioration caused by the two temperature histories of 204 and 408 days respectively.

tained in all transport facilities. The code accepts, however, exceptional instances where the temperatures have increased to +10°F. (−12·2°C.) provided that the temperature is immediately reduced to 0°F. (−17·8°C.).

The Djupfrysningsbyrån (1954)[8] requirement appears unnecessarily strict in that it requires −25° storage for all products. It is seen that this is not necessary for beef and poultry products. On the other hand it might be wise to require even lower temperatures for pre-cooked dishes.

The AFDOUS code permits a rise of temperature of the product to −12°C. It can be seen from the diagrams that even a temperature rise to −7° will do little harm compared to the effect of the storage accepted in the same code. On the other hand it does appear that storage at 0°F. (−17·8°C.) is not sufficient for all products.

It seems clear that any such regulatory work should consider the individual product more than has previously been the case.

Variation between products of same origin

It is clear from the TTT studies that much depends on the product, method of packing, etc.

Klose *et al.* (1959)[19] reported figures for frozen cut-up chicken packaged in superior and inferior materials (see Fig. 1). They showed that keeping quality for this product is largely dependent on the ability of the package to exclude oxygen.

Also, they showed that a superior type of package for this product will result in the same keeping time at −10°C. as is obtained for the same product in an inferior type of package at −21°C.

Guadagni and Nimmo (1957)[10] showed that vacuum packing may prolong the keeping quality of the colour of frozen peaches in syrup many times. The use of tin cans for packing instead of the usual composite container with metal ends may increase colour stability four times. Similarly, Guadagni, Nimmo and Jansen (1957)[13] showed that the ascorbic acid content is much more stable in peaches packed in hermetically sealed cans instead of the usual composite container.

The use of a nitrogen atmosphere prolonged the time of development of off-flavour in frozen, fried chicken meat from 0·5 to more than 12 months in experiments reported by Hanson *et al.* (1959).[18]

Guadagni *et al.* (1957)[13] showed that browning of peaches at freezer storage temperatures were highly dependent on package fill, a slack fill greatly contributing to browning. Using a tin can gave much better protection to frozen peaches than a composite waxed container. Evacuating the can greatly improved colour stability. A mild heat treatment proved effective in retarding browning.

Dietrich *et al.* (1959)[7] showed that correct blanching was of great importance for the preservation of colour of frozen green beans.

Also, the use of various additives to gravies and puddings had a very considerable effect in experiments reported by Hanson *et al.* (1957).[17]

Thus, it can easily be seen that much study must be devoted to better packaging methods, the use of inert gases, antioxidants, etc. Improvements in these fields may contribute very decisively to product development and acceptability.

Proposals for further studies

1. It appears desirable to make a complete literature survey to establish as well as possible the existing knowledge with regard to the keeping quality curves of various products of various origin and in various packages.

2. Since the American TTT programme has investigated vegetables, fruits and poultry products only, it is suggested that similar programmes be undertaken with regard to meat and fish and to products containing them. The programme should include both organoleptic tests and nutritive value determination.

3. Research on packaging and treatment of products prior to or during freezing is also very important. Fig. 1 shows for chicken that packaging is very important, and it is similarly indicated above that the treatment prior to freezing, *i.e.* blanching, etc., can be of great importance.

It appears that these tests could very well be carried out at elevated temperatures, *i.e.* −3°, −6°, −9°, and −12°C. Such experiments would yield results in a comparatively limited period of time and would give good information as to the keeping quality curve and the different keeping qualities obtained with various treatments and packaging methods.

It is likely that such tests should be supplemented by tests at −20 and −30°C. in order to determine the shape of the keeping quality curve.

4. A careful investigation should be undertaken to determine the temperature history of frozen foods as they are handled today in different countries. This will necessitate interviews along the lines carried out by Munter, Byrne and Dykstra (1953).[24] Besides, it will be desirable to make arrangements for easy recording of temperature in the packages throughout transportation and distribution.

Acknowledgment

The above are but a few preliminary conclusions drawn from the various reports regarding the U.S. Department of Agriculture Time-Temperature Tolerance Projects.

The highest admiration is due to the persons who originated and executed this programme. General and carefully prepared conclusions were presented to the industry at a Conference on Frozen Food Quality at Albany, California, in November, 1960 (Western Regional Research Laboratory, 1960).[27] The work has already proved invaluable to the frozen food industry and to the authorities who are to draw up regulations regarding the handling of frozen foods.

The literature references to which the numbers in the text refer are given on the next page.

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Oils and Fats

IN bringing the second edition of this book* up to date, the author has tried not to depart from his original intention to maintain a simple and compact treatise of this vast subject. For this reason it is an extremely useful reference book outlining the chemistry and technology of fats and oils.

It is difficult to single out any particular category of reader, apart from chemists, to whom this book will prove most valuable. Those engaged in the manufacture of fats and oils will find pp. 62-97 worthy of consideration. The section on edible fats contains short sections on salad and cooking oils, butter, margarine and lard.

The first four chapters are well set out, and deal with the occurrence, composition, structure and properties of fats in a logical manner. Chapter five deals effectively with the analytical and classification methods employed for examining crude and refined oils, including testing for oil-bearing matter.

By far the largest chapter is the one dealing with the technology of fats, pp. 62-164. This might have been subdivided into smaller chapters with advantage.

The use of oils and fats in making candles, linoleum, cosmetics, leather and pharmaceuticals, as well as other outlets, appears unfavourably placed under the chapter heading on the technology of fats.

Whilst the technical data given in appendix I are extremely useful it must be pointed out that the statistics are based on U.S. findings. The Glossary, pp. 217-229 appears to deal with subject matter which could well have been included in the text, and the book references, pp. 230-231 are mainly of American and German origin.

These criticisms should not detract from the scientific content of the book, and the tables depicting fatty acids, saturated and unsaturated, and their derivatives, pp. 8-13, do credit to the author.

* *Fats and Oils.* By H. Kirschenbauer. Reinhold Publishing Corpn., New York (Chapman and Hall, London), 1960. Pp. 240. Price 56s.

(*Left*): **A small 6-chamber demonstration vacuum gassing and sealing unit for Cekatainers.** (*Right*): **Examples of the Cekatainer, showing carton and inner liner.**

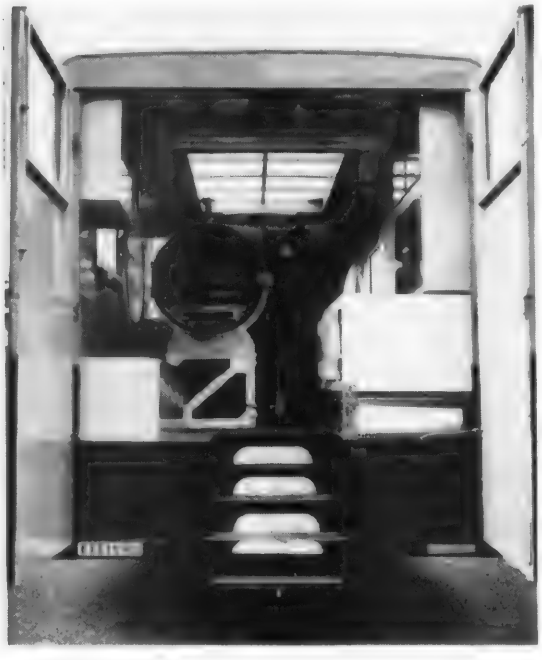
Mobile Freeze-Dryer for On-Site Demonstrations

Swedish A.F.D. packaging system now available in U.K.

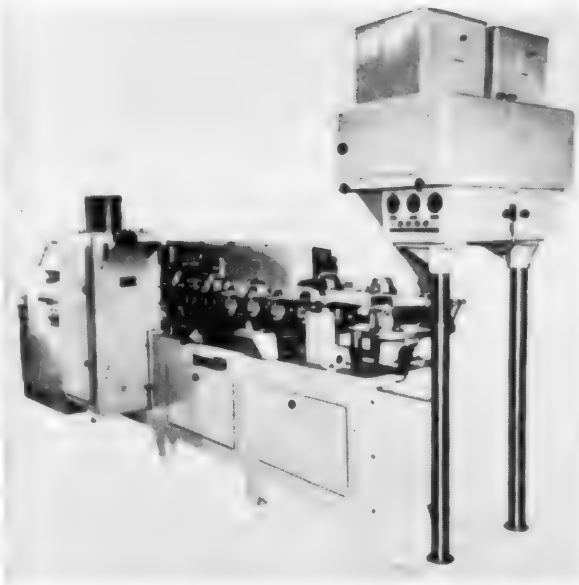
MITCHELL ENGINEERING, LTD., have put into service a mobile vehicle-mounted freeze-drying plant for giving on-the-spot demonstrations at food factories. At such demonstrations samples of foods are taken from batches which are to be conventionally processed and are freeze-dried in the Mitchell unit. They are then reconstituted so that the manufacturer can see how freeze-dried foods directly compare with the same foods processed by the normal factory routine.

We were recently invited to see this mobile plant in operation. At the same time we also saw a demonstration of the *Cekatainer* packaging system for A.F.D. foods, for which Taylowe, Ltd., hold the U.K. licence. This packaging system was introduced in 1955 by the Swedish firm of Christensson. The package consists of a heat-sealable liner inside a rigid carton, the liner being spot-glued to the carton interior. When filled, the liner is evacuated, filled with inert gas under reduced pressure and heat-sealed, so that the A.F.D. food is protected from movement, light, oxidation and moisture. The system also includes the appropriate carton forming, filling, vacuum, gas-filling and sealing machinery.

The Mitchell mobile plant—colloquially known as "Freda"—is a complete A.F.D. plant in miniature, comprising a blast-freezer, freeze-cabinet with radiant heating elements, vacuum pump



The mobile freeze-drying unit recently put into service by Mitchell Engineering, Ltd.



PA-33B machine synchronised with weighing equipment.

and refrigerated condenser. The Mitchell system differs from that of Vickers-Armstrongs previously described in this journal (July, 1960, p. 293, February, 1961, p. 60, July, 1961, p. 275, etc.) in that heating in the freeze-cabinet is by radiant heat instead of by means of contact heating elements, and a refrigerated condenser backed by a vacuum pump is used instead of steam ejection. The food is placed on fixed trays instead of on movable platens.

In conjunction with the mobile freeze-drying plant is a vehicle-mounted *Cekatainer* packaging plant in miniature. The two plants together thus form a complete portable A.F.D. processing and packaging system able to operate on any site and requiring merely to be plugged into a normal 30-amp. mains supply.

We were told that there is no financial link-up between Mitchell Engineering and Taylowe, the two firms finding it convenient to associate on a friendly basis, the one with its freeze-drying know-how going back over ten years and the other with its possession of and development work on the *Cekatainer* packaging system.

The "Cekatainer" system

This system, introduced by Christensson of Sweden in 1955, has been used in that country for a large variety of prepared and frozen foods, and since 1958, for the vacuum packing of coffee. The lined carton is particularly suitable for vacuum packs, and various lining materials can be used, such as coated cellulose, coated glassine, polyester, polyamide, polythene and aluminium foil. The liner is independent of the carton although lightly spot-glued to it; this ensures that the liner cannot shift relative to the carton although, when the liner is evacuated, individual glue spots may give way so that the outer carton retains its shape.

The machines available fall into two groups: the packaging unit and the vacuum unit.

Packaging machines

Machines available are the Ceka type PA-33B (45 packages per min.), the type PAC (60 per min.) and the PAC-49 (200 per min.). The first is an intermittent machine, the carton coming to rest while the stationary heat-sealing jaws seal the liner, while the two others are continuous, the heat-sealing unit travelling with the package throughout the sealing operation.

The PA-33B machine can be synchronised with filling machines such as the Ceka volumetric filler type VF-8 and the Ceka filling unit type IS-45, as well as with other types of automatic weighers. The IS-45 has been designed for such materials as frozen fish, steaks, fruit, etc.

Vacuum machines

Two Ceka machines are available: VP-51A (60 packages per min.) and VP-51B (90-120 per min.) They are designed for direct coupling to the packaging machines, and have 18 and 30 evacuating chambers respectively, each chamber holding one package. The packages may be either sealed directly after extraction or gas-filled to a pre-selected pressure before being sealed, the sealing operation taking place while the package is still in the chamber.

Toughness in Meat

(*Concluded from p. 516*)

position of the normal muscle cell is not fixed. We do not know whether the muscle cells of the bovine animal, the sheep and the pig have the same myofilamental and sarcoplasmic protein contents. It may be that differences in the protein composition of the muscle cells account for differences in tenderness in different cuts and species. A fundamental study along these lines carried out in conjunction with connective tissue studies might provide a more informative answer than we have at present to the question, "What causes toughness in meat?"

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A.F.D.—*Commercial Progress in Britain and U.S.A.*

THE foremost topic of conversation today in the U.S. food industry is that of freeze-drying. Dehydration by freeze-drying is the subject of articles, conferences, symposia, and many talks and discussions. What has become increasingly apparent is that the inherent economies of freeze-drying productivity must be rapidly developed if food manufacturers are to persuade and develop a mass-consumer market for freeze-dried foods. Consumers must be sold such advantages as convenience, consistent quality, easy storage and appetite-appeal.

Briefly, the advantages of freeze-dried food include shape retention, no refrigeration problems and quick re-constitution usually by soaking in water. Every product has its own hydrating method and time and this generally depends on thickness. Therefore, a wide scale of different hydrating methods are needed to return the food to its original texture, flavour and colour.

In the U.S., a large market has been established with campers and mobile persons who spend a considerable time out of doors. The demand is mainly for solid foods such as steaks and meat, but the main market under the parentage of large food manufacturers is for freeze-dried ingredients for complex foods and prepared dishes, such as soups, chicken dinners, chicken stew and vegetable beef dinners, where ingredients are virtually separate until cooked for home consumption. In the case of soups, this is a departure from the usual jumbled flavours as each ingredient, when freeze-dried, retains a separate flavour with a minimum of fusion, and therefore with added water, is cooked so that separate ingredients can be discerned.

The industry maintains that freeze-dried foods will remain edible for many years, although the general maximum for flavour and full nutrient-retention is about two years. One advantage over quick frozen food is that long length of frozen storage tends to accelerate decline in flavour and nutriment.

In an effort to reduce high cost of freeze-drying equipment, batteries of separate vacuum chambers in a group readily accessible to straightforward loading and unloading operations have aroused interest. These batteries or groupings, due to staggered loading of successive freeze chambers, are thought to present considerable savings in refrigerated condenser equipment and vacuum plants. A common instrument panel can be enlarged to organise multiple chambers using automatic control of the drying cycle. A recent installation in the U.S.A. is of four separate chambers in a battery, operated automatically from a single control panel thereby offering economy of labour.

Experiments during the past years at the D.S.I.R. Experimental Factory in Aberdeen showed that the drying cycle in freeze-drying could be shortened for particular food products without any detectable loss of quality. It was believed that such results could only be achieved by maintaining close contact with the heated platens of the product surfaces throughout the drying cycle. These opinions led to the design of a movable platen incorporating auxiliary metal mesh inserts between the product and the heated surface. Four chambers built by Vickers-Armstrongs, using this method, are in use at the factory of the Irish Sugar Company at Mallow in Ireland (see FOOD MANUFACTURE, July, 1961, p. 275). Atlas have installed two similar chambers in the plant of Armour and Co., Bellwood, Illinois.

Emphasis is on radiant heating

Recent experiments have indicated that decrease in drying time attributed to heat transfer by conduction, a result of maintaining continuous contact between product and heated metal surfaces, actually is the result of using much higher platen temperatures in the initial stages of sublimation than have currently been utilised in the past. It has been found that improved results can be obtained by radiant heat, removing the necessity of complicated and costly mechanism inside the chamber. Platen temperatures can be safely raised to 140-150°C. during the first hour without detectable injury to quality of the dehydrated food. This process speeds the vaporisation of water and poses the problem of corresponding faster vapour removal through condensation. Consequently, improved methods have been devised.

It has been found that drying cycles as short as four hours can be applied to diced chicken pieces with all heat transfer being effected through radiation. The resultant dried meat particles are more tender and of higher eating quality equal to diced chicken that has been freeze-dried in a 20-hour cycle under conventional operating conditions. This new technique lends itself to the installation of 10- and 12-chamber plants with outputs of 35 to 50 tons every 24 hours using three 8-hour shifts of operating crew. This general principle is in operation using six smaller chambers for cooked shrimp being freeze-dried on a 10-hour cycle with radiated heat transfer at the rate of nearly 10 tons of raw product every 24

hours. The chamber operation is automatically controlled from a single panel using cams properly cut to establish the desired cycle.

Commercial activities increasing fast

As early as 1939, a Philadelphia Company, F. J. Stokes Corporation, were conducting experiments of freeze-dried foods for human consumption. This company now manufactures equipment in Britain and counts more than forty separate food samples in their Philadelphia laboratories each having been dried, canned and stored ready for periodic taste sampling. There are approximately sixty vacuum chambers throughout the world being used either part-time or full-time for the commercial production of freeze-dried foods. Practically all large food manufacturers in the U.S. now have freeze-drying equipment either on the experimental and pilot-plant basis or models large enough for small commercial ventures.

Stokes' chambers now in operation by the United Fruit Company on the Gulf Coast produce freeze-dried shrimp and other foods. Wilson and Company have three Stokes' chambers, two are new, and could produce from 100 to 300 tons of precooked meat products a year. At present their operations include such products as beefsteak and pork chops, cube and minced beef and diced chicken. Much of their production is for commercial purposes. Aiming more at the consumer under their *Star Lite* Brand, Armour and Co., using several Stokes' chambers and two Atlas units, market from their Illinois plant such household lines as precooked scrambled eggs, beefsteaks, boneless pork chops, vegetable and beef dinner, chicken stew, and rice and chicken dinner. These items are packaged in foil-based laminates, overpacked with a cardboard carton and serve 2-4 persons. As yet, no annual volume figures are available due to these activities being a recent venture. But a rough estimate would indicate a daily capacity of 10 tons of raw material delivered to their Illinois plant for dehydration.

Thomas J. Lipton, using four Stokes' freeze-drying units produce dried diced chicken and dried mushroom pieces for their soup mixes. It is understood that their annual volume of chicken pieces is about 200 tons, while dried mushroom pieces account for 20 tons.

Campbell's Soups, Ltd., always abreast of modern techniques, are reported to have installed a large Stokes' system for commercial production, and it has been announced that a new line of dried soup mixes will incorporate freeze-dried products.

In Canada, commercial production of freeze-dried foods was inaugurated in Hamilton, Ontario, under the auspices of the Department of Defence Production. Production capacity is rated at 25 tons of dried products a year based on an 8 to 10-hour drying cycle.

Considerable progress in the application of freeze-drying in foods was made this year in Europe. The Irish Sugar Company with their Vickers-Armstrongs cabinets equipped with steam ejectors are commercially producing a variety of meat, fish and vegetable products. Leibigs have purchased an Atlas cabinet, also for installation in Ireland, presumably for drying of meat extract and other meat products. Coffee extract, freeze-dried by Brooke Bond with Mitchell Engineering equipment, is frozen on trays and the heat of sublimation is applied by heater plates situated above each tray and by circulating heated trichlorethylene through the tray. The process allows liquid coffee to be loaded and dried powder to be removed while the cabinet remains shut. Capacity of the four cabinets is rated at 2,700 lb. of coffee marketed in the U.K. under the *Priory* label.

Unilever, having taken over the MAFF Experimental Factory at Aberdeen, are anticipated to install two Vickers-Armstrongs pilot chambers. These units are of the size rated at 1¼ tons raw material capacity and the output of this plant is expected to be largely for commercial purposes and may also serve for experimental developments. J. Lyons and Co., who bought the Atlas plant from the experimental factory at Aberdeen, have produced experimental items on this unit such as potato chips, raspberries, chicken pieces, dried egg and tomato and vegetable soups in block form. They anticipate marketing trials of various freeze-dried packs, and might well use their chain of restaurants and hotels as outlets for freeze-dried foods.

Aerated Food are reported to be doing market tests in Aberdeen of a product known as *Scottea*. This is an instant tea converted by freeze-drying into a tea brew without concentration of the extract using Atlas cabinets. It is to be offered both as plain tea and as a mixture of tea and dried milk.

Recent machinery developments

With the exploiting of freeze-drying for commercial purposes, and bearing in mind the need to produce dried food products highly acceptable with retention of colour and flavour and minimum texture change, modifications in equipment designed to shorten the drying cycle materially and to effect economies in equipment cost and labour, have urged equipment manufacturers to redouble their experimental programmes. Recently, Stokes developed a multiple chamber of larger sizes, each approximating 1,000 sq. ft. of shelf area. It is known that Vickers-Armstrongs are experimenting with radiant heating in place of contact heating, while Leybold Elliott are developing a continuous plant utilising a freeze-drying tunnel.

▶ British Cellophane Limited have published "Presenting Biscuits," a glossy booklet covering copolymer-coated cellophane, current types of packaging, tray and carton overwraps, economy in multi-packaging and sources of supply.

With their booklet "Packaging with Sidac," British Sidac, Ltd., show how to wrap quickly and economically using the Multi-unit process.

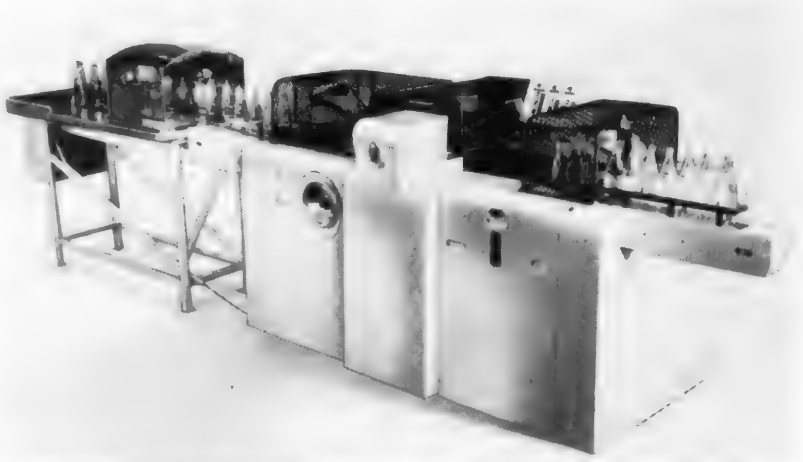
▶ "Cerelose" is a leaflet published by Brown and Polson, Ltd., explaining what cerelose is, how it is made and how it is packed.

MACHINERY and EQUIPMENT

BOTTLE WRAPPING MACHINE

A new machine for wrapping bottles in cellulose film has been introduced by Rose Bros. (Gainsborough), Ltd., the wrap not only enhancing the appearance of the bottle but ensuring against pilferage, particularly if a stopper which can be easily withdrawn is used. The wrap also preserves the appearance and legibility of any label which might have been applied.

Before entering the machine the bottles are positioned so that the film overlap appears on the glass and not on the label. Previously moistened bottles are automatically laid in a pocket chain made from rollers so that the bottles can rotate easily. As each bottle rotates, cellulose film cut from a reel clings to the wet surface, forming a tube which is gathered round the neck and twisted tightly at the stopper. The wrapped bottle is transferred automatically in the upright position on to a slow-moving belt where the pleats in the film are sprayed with moisture. Since the film is not moisture proof, it becomes skin-tight as it dries. The machine's output is 40-60 bottles per minute, according to the type.—**FM. 18.**



This new machine for wrapping bottles in cellulose film has been introduced by Rose Bros. (Gainsborough), Ltd.

PALLET TRUCK

An entirely new design of pallet truck, the *Vertopal*, lifts hydraulically from 3¼ in. to 7⅛ in. and is manually operated. The push-rods controlling the lift are of box section for maximum strength. The truck is suitable both for single- or double-decked pallets, maximum capacity being 2,600 lb. Various sizes are available, overall widths being 21 in. or 27 in. and finger lengths 36 in. or 48 in.

Floor-saving reinforced plastic steering wheels and aluminium finger wheels are fitted as standard equipment, but cast iron wheels can be supplied. The fingers are of high tensile steel construction. The ends are tapered and are also inclined slightly downwards for easier entry.

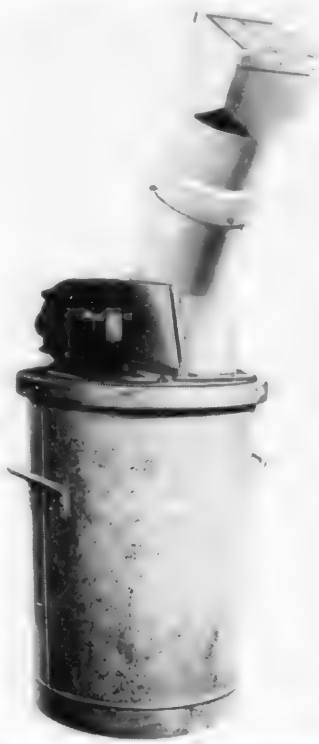
A feature of the truck is its manœuvrability. Distance between pallet and handle end of truck is only 13 in. Each finger has dual wheels for easy cornering and reduction of wear in wheels and floor. The twin steering wheels turn through more than 180° and are articulated to preserve stability on uneven floors. When not in use, the handle can be left in an upright position, where it locks itself by means of a spring-loaded plunger. For details quote **FM. 25.**

The " Vertopal " pallet truck.

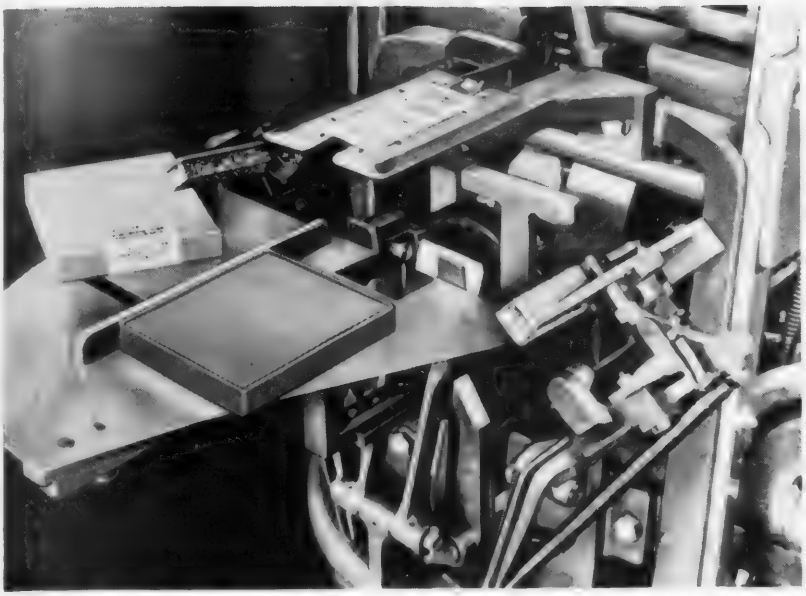
GLASS BREAKING MACHINE

Users of non-returnable bottles who have the problem of storing them while awaiting disposal appreciate that the air space occupied by the glass is out of all proportion to the actual quantity of glass involved. A glass and bottle breaking machine is now available to overcome this problem. It is made in two models, one in the form of a complete cabinet on its own casters, and the other, as the illustration shows, in the form of a separate unit which can be attached to a standard dustbin. A special hopper is also available for this model and can be fitted on to the funnel, thus facilitating the feeding of the unit by shovel.

Both models will break bottles with a minimum of noise, at the rate of 600 per hour, reducing them to one-tenth of the original bulk. For further details quote **FM. 26.**



The " Fortune " bottle breaking machine.



The Purdy "Universal" labelling machine adapted to handle end-seal labels on flat boxes.

This bin-type "Unimaster" dust filter has 100 sq. ft. of fabric filter area combined with motorised shaking gear and 4 cu. ft. quick-release container.

PIPE THREAD SEALING TAPE

A recent addition to the range of P.T.F.E. products manufactured by Turner Brothers Asbestos Co., Ltd., Rochdale, is pipe thread sealing tape. This unsintered tape is supplied as a continuous ribbon ½ in. wide on handy metal dispensers in lengths of 20, 30 or 40 ft., and is used for sealing threaded pipe joints at a rate never possible with previous materials. Breaking of the connection is easily accomplished, even after a long period of time.

The plasticity of the material ensures that it conforms exactly to the contours of the thread, resulting in a perfect seal against pressures of many thousands of lb./sq. in. It is also unaffected by temperatures ranging from −100°C. to +300°C., is chemically inert and will not cause contamination of the liquid being handled. Turner's P.T.F.E. tape is impervious to water, steam and most corrosive liquids and gases, and is unaffected by ageing or weathering.—**FM. 28.**

P.T.F.E. pipe thread sealing tapes made by Turner Brothers Asbestos Co. comes in a width of ½ in. in lengths of 20, 30 and 40 ft.

MODIFIED LABELLING MACHINE

The normal method by which a semi-automatic labelling machine applies a label to a container is by pressing the gummed label on to the container from the top or from the sides by one or two press or wiping movements, and in some cases a rubber roller is employed.

Faced with the problem of applying a label, gummed all over, to the top, side and bottom of a flat box, Purdy Machinery Co., Ltd., decided that this could best be achieved with a suitably modified version of their semi-automatic *Universal* machine.

The problem posed was for the end sealing, with one size of label, on to boxes ranging from 17 5/8 × 14 5/8 × 7/8 in. down to 3 13/16 × 2 5/8 × 7/8 in., gumming the surface of the label all over and thus providing a complete and unpilferable seal.

Modification, therefore, was made to the feed and wiper mechanism whereby a top and right angle press for the box, together with an under wipe for the underside of the label, was carried out simultaneously.

The complete box size range is covered by only one adjustment on the machine.

The modification takes the form of an adjustable guide which centralises the labels to the varying box sizes. Adjustment is a matter of seconds only. Speeds up to as many as 150 dozen boxes per hour can be achieved by a competent operator.—**FM. 32.**

SMALL DUST FILTERS

The bin type adaptation of the *Unimaster* venting unit answers the demand for a neat, compact piece of dust filter equipment for use as either a primary or secondary filter, in cases where a fan or pump is already part of the main machinery. This unit is fitted with "pad" type fabric filter of either cotton, nylon or terylene, giving 100 sq. ft. of filter area, together with motorised shaking gear and a 4 cu. ft. quick-release dust container. Details on application, quoting **FM. 36.**

NEW BANDSAW FOR MEAT

A new meat-cutting bandsaw has been introduced by Amasal, Ltd. This 14-in. machine is being made by another Staveley company, John Hill and Sons, Ltd., and marketed by the Butchers' Supplies Division of Amasal under their A.B.R. mark.

Commer " Walk-Thru " 2-ton van with 6-cyl. petrol or diesel engine.

Powered by a 3-phase, 2 horsepower electric motor, the new bandsaw has an aluminium polished table, 23⅛ in. by 31½ in. Height of cut and depth of throat are both 13 in. Top and bottom wheels are fitted with scrapers to ensure free running of blade and cleanliness of cut. Overall dimensions are: height, 51 in.; width, 33 in. It is priced at £215.—**FM. 35.**

DELIVERY VEHICLES

Designed specifically to meet the requirements of the multi-stop, short-haul operator, the 1½, 2 and 3 ton Commer range sets new standards of delivery efficiency, economy and driver comfort.

In the ingenious *Walk-Thru* cab the driver is offered unobstructed space, from floor to roof and from door to door, claimed to be unequalled in the light commercial vehicle market. From the pavement, the low step height affords easy entry. Steering wheel and column and the hinged and adjustable driving seat are positioned to give effortless entry and exit. The floor-mounted gear lever is located centrally and the handbrake lever is removed from the floor altogether and positioned tillerwise on the steering column.

The loading floor is an extension of the driving platform.

The range comprises a 1½-ton model with 123-in. wheelbase and the options of 2·26-litre and 3-litre petrol engines, as well as a 2·26-litre Diesel engine; a 2-tonner with wheelbases of 123 or 135 in. and the same engine options; and a 3-tonner with 135-in. wheelbase, powered by the 3-litre petrol engine or the Perkins 4/203 Diesel.—**FM. 34.**

NEW BAKERY MACHINES

American Machine and Foundry Co. have introduced five new bakery machines.

At the recent Baking Industry Exposition in New Jersey, AMF introduced five new machines—the world's first mass production unit for English muffins, which will automatically cut the pieces of dough to the right size, shape the muffins, raise the dough and put the muffins into the ovens for baking, all at a rate of 125,000 to 150,000 per day; a new bread wrapper, which will wrap approximately 30,000 loaves of bread per day in polythene; a new AMF jet spray pan greaser which greases the pans in which bread is baked; a new bread slicer with a slower blade rate speed which makes it possible for bakers using the AMF slicer to cut smoother slices with fewer crumbs and handle the loaves of bread more gently, and which will slice 30,000 loaves of bread per day compared to 28,000 loaves cut by conventional slicers; and the Glen 160 Mixer for cake and bread dough, the first complete push-button mixer controlled from one centralised control panel, featuring automatically timed mixing.

In the U.K., AMF bakery machinery is supplied by Simon-AMF, Ltd., of Cheadle Heath, Stockport, a company owned jointly with Henry Simon, Ltd.—**FM. 33.**

GLASS FIBRE SACK CHUTE

A glass fibre sack chute, lighter in weight but more rigid in construction than previous metal chutes, has been produced by Thomas Robinson and Son, Ltd. It is easier to erect, and the load on a building in which it is installed is considerably reduced. It is also cleaner and more modern in appearance. Designed in easily assembled sections, each 10 inches deep, the chute has an overall diameter of 5 ft. There are eight sections to a pitch, each pitch having a height of 6 ft. 10½ ins. The sections are bolted together at four points and are rigidly held by a 4½-inch steel tubing centre column fixed to a cast iron base. The makers say that tests for deflection and compression carried out with various products, in bags up to 2½ cwt. capacity, have shown that the chute is equally rigid when used for the storage of bags over a period.—**FM. 15.**

▶A system designed to overcome the problem of corrosive and greasy black particles from oil-fired installations is outlined in a brochure issued by Dust Control Processes, Ltd. The system consists of the introduction into boiler flue gases, by means of the D.C.P. Insufflator, of a finely divided alkaline hygroscopic precipitate, D.C.P. 58 Sulpho-neutraliser, at a controlled rate and under conditions which will ensure the intimate mixing of the particles of powder and gases. For this purpose the D.C.P. *Turbulator* has been designed to promote the mixing of D.C.P. 58 and waste gases, by employing a high carrier air exit velocity which causes the particles to be dispersed over a wide area, giving an even distribution. The separate units of the *Turbocell* can be arranged in capacity and number to supply various requirements.

A new glass fibre sack chute made by Thomas Robinson and Son, Ltd.

PACKAGING

Packs by British Cellophane, Ltd. (*Left*): **Multi-packaging of quick-frozen Devonshire White Crabmeat in MSAT/300/30 "Cellophane."** (*Right*): **"Dump-displayed" biscuits in a self-service pack in MXXT/S "Cellophane."**

Potato crisp display case

A new transit case/dispenser unit, designed and manufactured by Reed Corrugated Cases, Ltd., for the XL Crisp Co., Ltd., further develops the packaging and retailing of potato crisps.

The unit is dispatched from the manufacturer closed and filled with packets of crisps. On its arrival, the retailer sets up the pack, untucks the lid, folds it at the die-cut and scored line and retucks it, this time into the back of the case, where it forms a display backboard.

The pack is of corrugated fibreboard and gaily coloured in red and green to attract impulse buyers in self-service stores, where it is now on show.

"Cellophane" for crabmeat pack

Youngs Potted Shrimps, Ltd., have found that packaging their Devonshire White Crabmeat in MSAT/300/30 *Cellophane* is a very successful project. The *Cellophane* is supplied by British Cellophane, Ltd.

Six cartons are placed on a "U" shaped board and overwrapped with a single sheet of cellophane. The multipack makes a convenient wholesale unit for storage, dispatch and display. Goods can be identified at a glance, are easier to handle and are protected from dust and damp.

Cheese biscuit pack

As an incentive to customers, Peek Frean and Co., Ltd., are packing their *Cheeselets* in colour-printed *Cellophane* to add colour and sparkle to their product, which is on sale in many self-service stores.

The biscuits, manufactured from matured English cheddar, are visible through the transparent film, which keeps them fresh and crisp and stands up well to handling. The packs are of MXXT/S *Cellophane* made by British Cellophane, Ltd.

The XL crisp dispensing pack made by Reed. The pack acts as both transit case and counter dispensing unit.

ADVANCES in FOOD TECHNOLOGY

AROMA

Detection and quantification of aromas

In the course of tests based on the variation of the electric conductivity of liquids containing dissolved gases or vapours, it has been found possible to design special galvanic cells where one of the electrodes, generally a sieve, is in simultaneous contact with the electrolyte and with the analysed atmosphere whilst the other electrode is completely immersed. Due to electrochemical or even electrophysical action, the gaseous flow directed on the sieve which, with its bottom surface, is in contact with the electrolyte, produces a variation of the galvanic current between the two electrodes so that it can serve as a highly sensitive detector of minute quantities of gases or vapour. For instance, a platinum sieve in contact with distilled water, in conjunction with another electrode which may consist of platinum or lead, can be used for the detection of very small quantities of acids and bases, and this technique can be applied to the detection and quantification of many food aromas, after extraction and isolation by means of gaseous chromatography. The galvanic cells thus acting as "artificial noses" have been named "Osmopiles."—A. Berton, *Industries alimentaires et agricoles*, 1961, **78**, 521.

CANNING

Effect of storage temperature on canned fruit and vegetable quality

Twenty-six commercially canned fruit and vegetable products were stored at 75-80°F. and at 34-36°F. to study colour and flavour changes during normal and refrigerated storage and to demonstrate subjective changes that may accompany reported nutritive losses. All products displayed some colour and/or flavour changes at the higher storage temperatures; changes were generally significantly slowed by the lower temperatures. Changes observed at 75-80°F. storage were very marked quality loss in 10 products: 6 fruit drinks, 2 fruit-pie fillings, 1 fruit, and 1 vegetable product. Four products showed moderate change at 75-80°F.; 8 displayed slight changes; and one was benefited by higher temperature. Differential between rate of chemical reactions at 75-80°F. versus 34-36°F. determines the amount of benefit obtained from refrigerated storage of these canned foods.—Brody and Bedrosian, *Food Technology*, 1961, **15**, 367.

MEAT PRODUCTS

Detection of phosphates

In connection with the controversial question of permitting the addition of phosphates to meat or meat products, the detection of phosphates in meat has assumed greater importance. The Hungarian Meat Research Institute has investigated the factors affecting the "p-value" (*i.e.*, the relationship of the P_2O_5 content and protein content) in meat and meat products. The p-value was found to be lower in connective tissue than in muscular tissue. The p-value of back fat without lean generally exceeded that of raw meat. As the phosphorus and protein content of back fat are lower than those of raw meat, the effect of back fat content on the p-value is also liable to be reduced as a result of the phosphorus losses encountered during cooking and curing. The addition of phosphates can be verified most expediently by means of a control graph plotted from test results. The compilation and evaluation of such graphs is described in detail.—M. Cselkó and L. Körmendy, *Die Fleischwirtschaft*, 1961, **13**, 409.

Recent research on heating methods

The German Federal Meat Research Institute, Kulmbach, has carried out research on the heating phenomena encountered with pasteurisation and sterilisation in meat canning. When boiling in water, the proportion of the quantities of water and goods was found to have no material influence on heat penetration. But in modern air or steam cooking appliances, thermal conditions are apt to vary greatly, so that heat penetration may be retarded and heating conditions may differ considerably even within the same batch. If this fact is not taken into account failures due to inadequate cooking may occur. The cooking time may be shortened, and the quality thereby improved, by using can sizes specially suited for heat treatment or by using the rotary autoclave. The heat penetration in canned meat is liable to be retarded during the interruption of rotation for the purpose of sterilisation. To avoid failures through disintegration, the rotary speed should be at least 30, preferably 40 to 50, r.p.m.—Gisske, *Die Fleischwirtschaft*, 1961, **13**, 550.

Antioxidant effect of polyphosphates

The thiobarbituric acid test is used for determining the rancidities of cured meat products. Tests have been carried out at Sao Paulo, Brazil, to investigate the effect of prolonging the shelf life of cured meats with the aid of polyphosphates. These were added to the pumping pickle, and the rancidity was compared. The polyphosphates were found to have the effect of inhibiting the development of rancidity, thus preserving the colour of the product. In their aqueous phase, as with ham or sausages, polyphosphates are very effective antioxidants.—B. R. Suri, *Die Fleischwirtschaft*, 1961, **13**, 403.

Reducing the discoloration of hard sausages

Freshly smoked and short-time stored raw sausages have an attractive colour which does, however, deteriorate after about 20 days. The German Federal Meat Research Institute, Kulmbach, has investigated the technological possibilities of influencing colour development and retention. It was found that these could be influenced by the composition of the raw material and by a slight freezing of the beef portion which determines the colour shade. The freezing temperature should not be below −3°C., since lower temperatures will cause fissures from which the grey discoloration of the sausage mix emanates.—W. Iczacki, *Die Fleischwirtschaft*, 1961, **13**, 390.

MICROBIOLOGY

Microbiological control in vegetables for freezing

Methods of controlling microbial contamination of cut and French-style green beans during processing for freezing were studied. Chlorinated sprays reduced the number of microorganisms originating from belts. The practice of holding French-style beans in reserve resulted in significant growth of microorganisms on this product. Growth of organisms was not adequately controlled on enclosed equip-

ment such as a filling machine. The results stress the need for improved sanitary design of equipment, more effective cleaning methods, and modifications in processing procedures.—Splittstoesser *et al.*, *Food Technology*, 1961, **15**, 329.

MILK

Natural and chemical factors in preservation

The natural constituents of milk have a marked bacteriostatic effect during the first 24 hours after milking. Among artificial preservatives, hydrogen peroxide and oxygen appear to be the only ones harmless and effective enough for practical use. Hydrogen peroxide, added to the milk immediately after milking at the rate of 0·2%, is able to preserve the milk in perfect condition for between 24 and 48 hours; a higher rate would affect the organoleptic qualities of the milk. Under emergency conditions, such treatment can be used as substitute for pasteurisation. Oxygen treatment, too, appears to have a field of practical application, whilst other chemical preservatives such as hypochlorites, formaldehyde or trichloro-nitromethane have given rise to practical difficulties of various kinds.—C. Ravazzani, *Minerva Dietologica*, 1961, **1**, 45.

PACKAGING

Technical advances in packaging

A paper read to the Royal Society of Arts describes techniques developed to protect goods from various hazards —*e.g.*, transportation, climate, light and radiation, and biological. Techniques available for testing packages to ensure their suitability to withstand these hazards are described.—V. G. W. Harrison, *J. Roy. Soc. Arts*, 1961, **109**, 821.

Suitability of plastics

Wrappings made of plastics have revolutionised the food packaging and conditioning industry. Plastics are able to offer effective mechanical protection against erosion, perforation, shocks, vibrations, etc.; their permeability to gases, water vapour, organic vapours, aromas and liquids can be varied in accordance with given specifications; most of them have a high chemical inertia; they are light in weight, inexpensive, easy to weld, and able to present the wrapped goods in an attractive and decorative way. But it is necessary to take into account certain physico-chemical and toxicological aspects. If this is done, plastics will be found to be specially suitable as wrappings for fresh food eaten soon, or placed in refrigerators, and also as canning material for certain semi-preserves. Moreover, there appears to be a continually widening field of application for plastics wrappings in the form of films and bags.—R. Lefaux, *Revue de la Conserve*, 1961, **16**, 63.

SMOKING

Role of smoke particles

Wood smoke consists of two discrete phases, a disperse liquid phase—smoke particles—and a dispersing gas phase—smoke vapours. These phases constitute a partition system, individual smoke constituents being distributed between them according to their respective partition coefficients, following Nernst's law. When the partition equilibrium is disturbed—*e.g.*, by diluting the smoke with air or by scrubbing out smoke components from the vapour phase, or when the partition coefficients are changed—*e.g.*, by raising the temperature, a transfer of smoke constituents from the disperse liquid to the vapour phase occurs. This results in a change in the relative mass concentrations of individual smoke constituents in the vapour phase, the vapours becoming relatively richer in non-volatile and poorer in volatile smoke components. Since the rate of absorption of smoke compounds by water is proportional to their mass concentration in the vapour phase these changes in vapour composition are reflected in changes in the composition of the smoke deposits.—Foster *et al.*, *J. Sci. Food Agric.*, 1961, **12**, 635.

STORAGE

Effect of humidity on stored butter

Unwrapped samples of salted sweet-cream butter were stored in darkness at 1°C. for 6-8 weeks over silica gel, water, isotonic salt solutions, and in free air. Moisture and fat peroxide gradients from the surfaces to the interior of the stored samples were measured in thin sections obtained by a simple macrotome technique. The surface oxidised at the same rate as the rest of the butter and its rate of oxidation was not affected by moderate drying or moisture uptake. With severe surface drying, especially when induced by silica gel, fat oxidation was inhibited, while moisture uptake by the more heavily salted butters promoted surface oxidation.—Pont and Rogers, *J. Dairy Res.*, 1961, **28**, 151.

Chemical changes in frozen fish

The effect of frozen storage and glazes on some chemical changes in fish was studied. Moisture content decreased on storage, whereas total protein nitrogen apparently increased. Total amino-nitrogen decreased. The loss in total amino acids and change in PDR index of fish was observed during frozen storage. The changes mentioned above were slowed by glazes. The ratio of Ba-acetate non-precipitable ribose to total ribose increased during storage. The possible route of formation of Ba-acetate non-precipitable ribose has been suggested. —Sawant and Magar, *Food Technology*, 1961, **15**, 347.

Wasa Crispbread Factory

(*Concluded from p.* 510)

has decreased. The following table, giving the number of accidents a year per hundred workers in the years 1950-59, shows how matters have improved:

1950	1951	1952	1953	1954
29	23	24	15	16
1955	1956	1957	1958	1959
7	8	9	8	7

Quality control

To maintain a consistent high quality in the bread it is essential to have a large number of daily tests of both raw materials and finished bread, and these are carried out in a well-equipped laboratory on the premises. Amongst the tests can be mentioned one of special interest where the rye grain is tested for vitality by a Danish machine which makes it possible to see in a matter of minutes results which would normally take several days' growing time. Another test, this time on the baked bread, subjects it to different pressures for degree of hardness, the pressures corresponding to the chewing powers of human teeth.

In addition to the work of this laboratory, the Wasa factory carries on subsidiary experiments in co-operation with many research units in different parts of Europe and America. Its chief research chemist, David Karp, was in fact granted the freedom of Kansas City due to his important research work there.

England has not so far been one of Wasa's large export markets, but at present a big advertising campaign for Wasa's Ry-King Crispbread is going on in co-operation with Nabisco Foods, Ltd., and there are hopes that considerable progress will be made.

NEWS DIGEST

Next President of F.M.F. elected

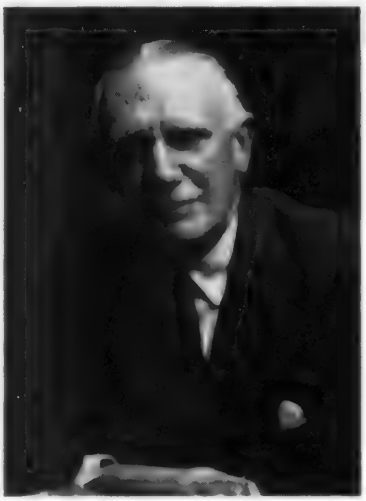
Mr. Lauchlan Rose

Mr. Lauchlan Rose, M.C., a director of Schweppes, Ltd., and chairman of L. Rose and Co., Ltd., is to be the next president of the Food Manufacturers' Federation Incorporated.

This was the unanimous decision of the Council of the Federation which met on November 2 to appoint a successor to Mr. J. P. Van den Bergh, C.B.E., a director of Unilever, Ltd., who will complete his three-year term of office—the maximum permitted under the Articles of the Federation—on December 31 next.

Mr. Rose has been a member of the Executive Committee of the Federation since 1945, and from 1942-49 he was chairman of the Soft Drinks Section of the Federation.

Educated at Marlborough and Trinity College, Cambridge, Mr. Rose saw active service during the First World War in France; he was twice wounded and awarded the M.C. in 1916. On leaving the Army in 1919 Mr. Rose joined L. Rose and Co. and was appointed general manager in 1924. He became managing director of the company in 1925 and chairman in 1933.



During the last war Mr. Rose was a member of the Committee of the Soft Drinks Industry Wartime Association and the Fruit Juice Control Committee. From October, 1944, to November, 1946, he was also chairman of the Committee of all Sections of the Soft Drinks Industry which drew up proposals for post-war standards. Between May, 1954, and April, 1955, he served as chairman of a subsequent Committee of the Industry to revise these standards.

Mr. Rose joined the Board of Schweppes, Ltd., and Schweppes (Overseas), Ltd., in 1957. In 1959 he was appointed chairman of Chivers and Sons, Ltd., and is a director of Connaught Food Products, Ltd.

Lightnin Mixers forms French subsidiary

Lightnin Mixers, Ltd., specialists in fluid mixing and agitation machinery, have celebrated their first birthday as a company by setting up a French subsidiary. Known as Lightnin Mixers (France) S.A., it has headquarters in Paris and will be responsible for sales of the complete range of Lightnin Mixers equipment throughout France.

Lead in food regulations

Regulations made by the Minister of Agriculture, Fisheries and Food jointly with the Minister of Health lay down statutory limits for the lead content of food and beverages imported, sold or intended for sale for human consumption.

They limit to 0·2 p.p.m. the lead content of ready-to-drink non-alcoholic beverages, limit to 2·0 p.p.m. the lead content of other foods, and allow, for certain specified beverages and foods, different limits which in certain instances apply only for a limited period.

They do not apply in the case of fish (including crustacea and molluscs) or any product containing such fish for which a natural lead content in excess of 2·0 p.p.m. has been established, nor where certain food contains lead in proportions exceeding 2·0 p.p.m. by reason of the inclusion, as an ingredient or ingredients, of a substantial quantity (defined as not less than 25% by weight of the composite article of food) of a food or foods specified in the Schedule to the regulations; and where such excess of lead does not exceed the maximum quantity, proportionate to its weight, permitted for the added specified food or foods.

The regulations provide that where any food is certified by a public analyst as being food which it is an offence against regulation 3 to sell, consign or deliver, or import into England or Wales, that food may be treated for the purpose of section 9 of the Food and Drugs Act, 1955 (under which food may be seized and destroyed on the order of a justice of the peace), as being unfit for human consumption.

H.P. Sauce, Ltd.

The directors of H.P. Sauce, Ltd., announce that the company has acquired, for cash, the whole of the share capital of Pazo Co., Ltd., of Oldbury, manufacturers of printed cartons, cardboard boxes, reels and tubes.

Raw cocoa usage

The MAFF estimates that 16,500 tons of raw cocoa were used by manufacturers of cocoa and cocoa products in the United Kingdom during the 13 weeks ended September 30, 1961.

In the 13 weeks ended July 1, 1961, 20,300 tons were used, and in the 13 weeks ended September 24, 1960, 15,500 tons.

Tate and Lyle reorganisation

As from October 1, Tate and Lyle, Ltd., are now purely a holding company. The whole of the company's refining undertaking has been taken over by a new wholly owned subsidiary company, Tate and Lyle Refineries, Ltd.

All current and pending contracts entered into by Tate and Lyle, Ltd., in the normal course of its business as sugar refiners will, as far as is practicable, be assigned to the new company which will be responsible for their implementation and completion.

Wall's (Handy Foods) to expand

A programme for the further expansion of Wall's handy foods was outlined by the Sales Manager, Mr. Alan Marshall. Mr. Marshall emphasised that this expansion had been made possible by greatly increased sales in vacuum packed bacon. An increasing demand by the consumer for standard high quality packed products, together with an increase in supermarkets and self-service outlets, meant that vacuum packed bacon was becoming popular.

B.B.I.R.A.—controversial proposal deferred

At the annual general meeting of the British Baking Industries R.A. held at the Trocadero Restaurant, London, on October 26, a proposal that Article 23 of the Articles of Association be deleted and replaced by another article was deferred for one year. The proposed article to be substituted read: "The Council may invite up to six companies controlling a substantial share of the baking industries in the United Kingdom and who are Ordinary Members of the Association to nominate a representative each to serve on the Council. Each such company shall have the right to remove any person so appointed and in that event to appoint another person in his place." Discussion on this point took up most of the meeting's time.

The meeting was followed by a paper read by Mr. T. H. Collins of the R.A. staff on "The Chorleywood Bread Process." At the luncheon which followed the guest of honour was Lord Rank, chairman of British Bakeries, Ltd. (*Editorial comment*, p. 502.)

New chicken processing factory

The Buxted Chicken Co. has opened a new processing factory at Boreham, near Chelmsford. The factory, which cost £350,000 to build and gives work to some 200 people, is built on the same site as the old premises which were established nine years ago. Estimated production from this plant is 100,000 pre-packed, deep-frozen, oven-ready chickens a week.

AMF acquire D. K. Hamblin

AMF, Ltd., have acquired the shares of D. K. Hamblin and Co., Ltd., of Radcliffe-on-Trent, Nottingham.

D. K. Hamblin and Co., Ltd., was established in 1946, and is engaged in the manufacture of food processing machinery, sheet metal components, tobacco processing machinery, and specialised machinery for the chemical industry. Over half of Hamblin's production is exported.

The D.K. Hamblin plant at Radcliffe-on-Trent is of modern construction and covers an area of 38,000 sq. ft. An additional 45,000 sq. ft. is available for expansion.

Birds Eye developments

For the first time exports of Birds Eye quick frozen foods will this year reach £1,000,000. The company say that export sales have doubled every year since 1957.

Because Australia can supply only a small quantity of fish for her own consumption, a large amount of Birds Eye fish fingers and fillets are imported there. Australia is Birds Eye's biggest single overseas market.

Lord Rank, who was guest of honour at the B.B.I.R.A. annual luncheon on October 26, recently visited the Chorleywood Laboratories. He is seen here examining a bloomer loaf made by the Chorleywood bread process, while Dr. R. T. Colgate, Dr. N. Chamberlain, Dr. G. A. H. Elton and Mr. T. H. Collins (*l. to r.*) look on.

One of the limiting factors in the frozen food export business is the lack of an efficient cold storage in all but the biggest markets. Frozen foods must be held at a certain temperature until they reach the consumer, but in spite of distribution and storage problems, many products are being shipped to areas where facilities are very limited.

The company say that cold stores either completed or in the course of construction during 1961 will give them an increase of one-third of their previous depot storage capacity. When the last of the current projects is completed this month, there will be gross storage space for more than 9,000 tons of quick-frozen food in the company's 45 regional depots.

Additional storage space has become essential because of the company's rapidly increasing sales. Last year the industry's turnover was £46,000,000, and by the end of 1961 it will have increased to £57,000,000. Birds Eye have approximately two-thirds of this market.

Britons like strong curry

Veeraswamy's have launched a new kind of canned curry which is to be distributed by Maconochie Bros. The curry, available in three strengths, must have water added, be heated and then poured on to the dish, which is usually chicken or lamb.

While continental palates prefer the medium strength, the stronger variety is more popular in England.

New Glaxo milk-drying factory

Construction of a £200,000 milk-drying factory at Kendal, Westmorland, for Glaxo Laboratories, Ltd., began in September.

Covering an area of nearly 44,000 square feet, it will be a six-bay, single-storey, steel-framed building, brick clad, and will provide accommodation for milk-drying equipment and appropriate dairy facilities, laboratory, office and warehousing. It is expected that it will be ready to receive plant installation by February, 1962, with completion at the end of May, 1962.

Fats congress next April

The 6th I.S.F. Congress, organised under the auspices of the Society of Chemical Industry (Oils and Fats Group), will take place in London from April 9 to 13, 1962, the first day being reserved for registration of delegates, followed by a general meeting of I.S.F. members and an informal social evening.

The Congress will be formally opened by the Lord Fleck, President of the Society of Chemical Industry, at the Plenary Meeting on April 10 when he and the President of the Congress, Dr. E. G. Woodroofe, will welcome delegates from some thirty countries. Over 200 delegates have already registered provisionally.

The Preliminary Programme of the Congress may be obtained from the Congress Secretariat, 14, Belgrave Square, London, S.W.1.

Meredith and Drew's New Plant Opened

A new plant line, part of Meredith and Drew's modernisation scheme at their Halifax biscuit factory, was named on November 15 by H.R.H. the Princess Royal.

Her Royal Highness was welcomed at the factory by Mr. P. J. A. Lachelin, chairman of Meredith and Drew, and his board of directors, together with the Mayor of Halifax (Ald. Mrs. Winifred Oxley, J.P.). The naming ceremony, at which the new plant line was christened "Harewood," took place after the Princess Royal had attended a luncheon with directors and guests of the company in the staff canteen.

At tea, Mr. R. Y. Fison, managing director, presented her with a specially designed casket of biscuits, and then Meredith and Drew sent a gift of biscuits to the Horsfall Home for the Blind in Halifax to mark the occasion of the Royal visit.

Among the employees presented to the Princess Royal was Mr. William Wilcocks (63) of Halifax, who completes 50 years' service with Meredith and Drew this month.

The new Harewood plant is part of the company's modernisation scheme at Halifax and will produce over 100,000 biscuits an hour. The whole scheme incorporates many modern production refinements, including automatic dispensing and mixing of basic ingredients. The other plant lines at this factory are named after well-known Yorkshire rivers, among which the new Harewood plant now takes its place. (A report of the plant will appear in our next issue.)

Meredith and Drew to close part of works

Meredith and Drew, Ltd., are being forced to transfer part of the production and plant of their Cinderford factory to other factories in Halifax and Ashby, but are maintaining one biscuit plant and are considering the possibilities of a new potato crisp factory in the Cinderford area to help uphold the labour force there. A decision on this project cannot be made until next year.

Meanwhile, the company will operate a scheme of compensation, varying with the length of service, for all employees who become redundant as a result of the contraction of production at the factory.

New Italian periodical on dietetics

The Italian publishing house, Edizioni Minerva Medica, Turin, has now added, to its long list of specialised periodicals, a three-monthly review entitled *Minerva Dietologica*, which brings contributions from eminent scientists and research workers on all kinds of dietetic problems. The first number, which appeared in June, 1961, contained articles on proteins, on recent progress in dietetics generally, and on dietetic therapy and technology. An extensive bibliographical section covers many international periodicals dealing with dietetics and nutrition.

Sixth international nutrition congress

The VIth International Congress on Nutrition will meet in Edinburgh, Scotland, in 1963, from August 9 to 15.

The congress is held under the auspices of the International Union of Nutritional Sciences and is organised by the Scottish Group of the Nutrition Society, which is the host organisation.

Further details may be obtained from the Secretariat, Department of Clinical Chemistry, Royal Infirmary, Edinburgh, Scotland.

Forthcoming Meetings

S.C.I. Food Group, 14, Belgrave Square, London, S.W.1; December 1, joint meeting with Manchester Section, "Microbiological Control in Food Production," by D. A. Shapton; December 13, 18.15, at Belgrave Square, Nutrition Panel meeting, "Foods low in Carbohydrates."

Institute of Refrigeration; December 7, 17.30, at Institute of Marine Engineers, 76, Mark Lane, London E.C.3, "Developments in Storage of Fruits," by J. C. Fidler.

". . . and Wilkins here is conducting an exhaustive survey into consumer preferences."

Food poisoning in 1960

In a report of the Public Health Laboratory Service on Food Poisoning in England and Wales, 1960, published in the Monthly Bulletin of the Ministry of Health and the Public Health Laboratory Service, September, 1961, p. 160, the following comment is made: "The picture of food poisoning in 1960 was substantially similar to that of previous years and calls for little comment. Salmonellosis remains the most serious problem but a welcome fall was observed in salmonella incidents, especially those due to types other than *Salm. typhi-murium*. It was mainly accounted for by decreases in the number of incidents due to ten types of *Salmonella* which in recent years have frequently been isolated from egg and meat products. Whether this presages a permanent fall in incidents due to types from these products will not be clearly demonstrated for some years, but it may be hoped that it is an indication that egg products and meat products such as boneless beef, boneless veal and sausages are being produced with greater regard to the risks of infection."

In England and Wales in 1960, 6,428 food poisoning incidents were recorded —262 general outbreaks, 616 family outbreaks and 5,550 sporadic cases. This represents a reduction of 18% compared with 1959. Canned meats were mentioned in an unusually large proportion of the total outbreaks associated with meat (17% in 1960 compared with 3% in 1959 and 8% in 1958). Altogether 24 outbreaks associated with canned meat were reported; all were due to *Staph. aureus*. In 17 the meat was known to have been eaten as soon as the cans were opened. Twenty-one were associated with corned beef and in 15 of them the beef came from East Africa.

Another equipment sale to U.S.S.R.

Robert Kellie and Sons, Ltd., have obtained an order from the Russian Government for £400,000 worth of equipment for the storage of potatoes, and for the manufacture and packaging of potato crisps, potato chips and potato cakes.

New agent for milkstone control

Diversey (U.K.), Ltd., announce the immediate introduction of their newly formulated *Dilac* for the control of milkstone deposits in milk and cheese plants, processing dairies, creameries.

This compound is non-aerating and claimed to be much more effective in its cleaning action, since a 100% active cleaning solution is circulated through the system.

It is claimed that the regular use of this product, either daily or weekly, will provide complete control of milkstone in the milk processing plant.

Food in Parliament

No mention of Weights and Measures Bill

The Government's failure to re-introduce legislation on weights and measures—the original Bill was lost because of a shortage of Parliamentary time last session—has been criticised by Members.

There was no mention of the Weights and Measures (No. 2) Bill in the Queen's Speech outlining the immediate legislative programme for the new session. But it may make its appearance later on.

The omission of the Bill from the announced programme was attacked by Labour M.P.s, who tabled an amendment to the Address in reply to the Queen's Speech, regretting that no reference had been made in the speech to legislation to protect consumers.

It particularly regretted the absence of a Bill to bring the law on weights and measures "into line with modern trading practices for the protection of shoppers and reputable traders."

Warning of import duty on butter

Because the New Zealand dairy industry has been threatened with material injury from dumped and subsidised butter imports into Britain the Board of Trade is to take action.

Mr. Frederick Erroll, President of the Board of Trade, gave a warning in Parliament last month (November) that Britain will have to impose anti-dumping duties on butter unless pressure on the market is reduced. Exporting countries have therefore been requested to limit shipments for a six-months' period ending March 31 next, otherwise steps to put on anti-dumping duties will have to be taken.

When a plan for limitation of supplies to Britain was discussed at a GATT meeting in September, New Zealand, Australia, Denmark and the Netherlands indicated their willingness to regulate shipments, provided other countries did the same.

Nylon flexible container

A flexible container called the *Pak-O-Bel*, sufficiently strong to carry a ton weight and yet capable of being carried (empty) like a golf bag, has been invented by Commander Stanley Bell, managing director of Elliott Equipment, Ltd., Lisburn, Northern Ireland, and is expected to reduce transport costs considerably.

Commander Bell has stated that full, either of solids or liquids, the container can hold one ton and, empty, fold into a very small space and weigh about 40 lb. During the next year it is planned to produce some thousands of them.

The containers are manufactured at the Altona Works, Lisburn, where most of the employees are concentrated on turning out inflatable liferafts and similar types of equipment.

Other Northern Ireland workers stand to profit from the invention, because the main material used is high tenacity nylon produced near Derry by Du Pont, and covered in black synthetic rubber. Its strength is apparent from the fact that containers have been successfully tested for the transport of such items as sugar, potatoes, oils, wet fish, and cement.

Another of the container's advantages is that it sits square, supported by metal ribs at the four corners, and can be stacked one on top of the other without crushing the contents.

More sugar from Sankey

To keep pace with the growing national demand for packeted granulated sugar, the Sankey Sugar Co., Ltd., a member of the Manbré and Garton group, has just completed work on the first stage of an extensive modernisation programme at its Earlestown, Lancs., refinery.

An £85,000 extension to the packeting department, including installation of new machinery, is part of a major development programme designed to increase the productivity of the refinery.

More sorbitol for food use

The new sorbitol plant of Howards of Ilford, a member of the Laporte Industries Group, is now in production, and has an annual capacity of 4,000 tons of 70% syrup. Because it is free from any toxic hazard, this syrup is particularly suitable for use as a humectant in food and confectionery, pharmaceutical and toiletries industries.

Milk industry award

The Central Milk Distributive Committee, in recognition of the services rendered the dairy industry by Stanley Clifford, C.B.E., B.SC., who was for many years chairman of the committee, has established a fund to enable a suitable applicant to make a short study tour of the dairying industry in the U.K. or abroad.

Employees in the dairy industry or in dairy engineering in the U.K. who are below the age of 30 are eligible.

The Society of Dairy Technology will administer the award, which will be made annually.

The first award will be granted for a study tour in Denmark immediately following the International Dairy Congress, which is to be held in Copenhagen during September 3-7, 1962. Particulars may be obtained from the Secretary, Society of Dairy Technology, 17, Devonshire Street, London, W.1, not later than January 31, 1962.

OBITER DICTA

● Potatoes make an excellent base for effective Christmas decorations.—*Press handout.*

● Ward Baking Co. has a new machine that squeezes bread to test its freshness.—*Chemical and Engineering News.*

● Lord Amwell said the nation would be happier, better and more moral if there was a return to eating food "straight from the earth."—*The Times.*

● Lord Auckland said the term "pork pies" seemed nowadays to cover a multitude of sins. While in one shop a very good pork pie could be bought, in another one got something which had a taste he could only describe as a combination of sawdust and bad grease.—*The Times.*

● A U.S. scientist on tyre cord research discovered a "jelly-like mess" of cellulose and found it was edible. Now, says *Life*, the new "non-food"—non-nutritious, vitamin-free and un-tasty—is to be put on sale for slimmers. It prevents feelings of hunger.—*Financial Times.*

● 75% of the married women in this country watch television, and are constantly being told to make themselves more beautiful. After that, do you think the housewife has any inclination to wash, clean and prepare vegetables in the state in which the wholesale trade supplies them? Look into your dustbin after a weekend and see the vegetable waste.—*Covent Garden wholesaler.*

● Since New York's budget-conscious Parks Department took over the job of supplying the Mayor's residence with food, there has been a reduction of 80% in bills for meat, fish, vegetables, and fruit . . . Proudly showing the bill for last December, the Parks Department pointed out that the total was only £174. New Year's Eve bill was £10 7s., and included crab, two pheasants and 6s. 4d. worth of indigestion tablets.—*Daily Telegraph.*

● The reply of a potato to Mr. John Prince's letter in your paper would probably be that with mechanical planting in about 15 cwt. of artificial manure to the acre, followed by about four lots of spraying to prevent blight, culminating in a noxious spraying to kill the tops, then more mechanical handling to lift, sort, load, etc., what do you expect the spud of today to look and taste like?—*Letter in Daily Telegraph.*

Biscuit machinery for India

Parle Products, Ltd., Bombay, have made a contract with T. and T. Vicars, Lancashire, worth £35,000. Vicars are to supply automatic biscuit-making equipment, including two double-spindle vertical mixing machines and a high-speed embossing and cutting machine which is fitted with a dough sheeting unit, flour dusters and standard automatic scrap return conveyor built alongside the machine to return scrap dough to the sheet hopper.

Due to import restrictions, terminal drums and band for the continuous heavy wire mesh band oven, will be built in India.

Showerings, V.P. and Whiteways to merge

Three well-known drink manufacturers—Showerings, Vine Products and Whiteways Cyder Company—propose to amalgamate to form a group which will have net assets of more than £10.3 m.

This will bring under common ownership Babycham, made by Showerings, Britvic fruit juices, produced by Vine Products, and Sanatogen Tonic Wine, one of Whiteways' products. Other products made by the proposed group include V.P. wines, Whiteways' and Duval wines, and Whiteways', Coates' and Gaymer's ciders.

The merger will be made through a new holding company to be named Showerings Vine Products and Whiteways, which will offer its shares in exchange for those in the present companies on terms drawn up in consultation with Philip Hill Higginson Erlangers.

Chairman of the new company will be Sir Ronald Howe, who is chairman of Vine Products.

Last June, Showerings acquired William Gaymer and Son, of Norfolk, Britain's oldest cider-making company. —*Financial Times.*

Erections and Extensions

North Eastern Direct Supply Co., Ltd., are having a mineral water factory built at Penshaw, Houghton-le-Spring, Co. Durham.

■

West Cumberland Farmers' Trading Society, Ltd., are having a potato washing and packing factory built on the Fence Houses Trading Estate, Houghton-le-Spring, Co. Durham.

■

Avana Associated Bakeries, Ltd., are extending their bakery at Cardiff, South Wales, at a cost of roughly £100,000.

■

Idris, Ltd., soft drinks manufacturers, have plans in hand for the erection of a warehouse and office premises at White Hart Lane, Wood Green, London, N.22.

■

Nestle Co., Ltd., are rebuilding their factory in High Street, Aylesbury, Bucks.

■

William Milne (Falkirk), Ltd., box makers, are having a factory built on a site in Burnbank Road, Falkirk, Scotland, at a cost of £42,000.

■

Greco Brothers, Ltd., are having a biscuit factory built on a site in Florence Street and Lloyd Street, Middlesbrough, Yorks.

Rington's Tea Co., Ltd., are having a tea warehouse and office premises erected on a site in Algernon Road, Newcastle-upon-Tyne.

■

Reavley's Mineral Water Co., Ltd., are extending their factory at Jarrow, Co. Durham.

■

Smith Brothers (Quinton), Ltd., packing case manufacturers, are having a factory built at Bo'ness, West Lothian, Scotland.

■

W. J. Barton, Ltd., bakers, are extending their bakery in Kemp Road, Dagenham, Essex, at a cost of £20,000.

■

Adams (Dalkeith), Ltd., cooked meat and sausage manufacturers, are having a 12,000 sq. ft. factory built at Ramsey Croft, Dalkeith, Midlothian, Scotland.

■

Frank Cooper, Ltd., preserves manufacturers, Botley Road, Oxford, are having a 30,000 sq. ft. factory built on a site off Grove Road, Wantage, Berkshire.

■

Nestlé Co., Ltd., are having a *Nescafe* block built as an extension to their factory in Nestlé Avenue, Hayes, Middlesex. Cost of this development is estimated at £180,000.

Notes for Contributors and Authors

The Editor of FOOD MANUFACTURE welcomes articles, news items and other contributions on all aspects of food production.

The purpose of this journal is to exchange information between all those concerned in the food industry. Articles should therefore be written in a readable style, avoiding esoteric terminology and technical jargon, and should contain factual and practical information.

A preliminary synopsis should, preferably, be sent to the Editor.

The Royal Dairy Show is reviewed . . .

. . . in the December issue of **Dairy Engineering** and a look is taken at modern trends in Yoghurt manufacture.

The second part of an article on development and planning chemical processes and the principles of corrosion applied to chemical plant are examined in this month's **Chemical and Process Engineering.**

An article on computer trends, production and methods appears in **Automation Progress.**

World Crops is publishing a special feature on pests and their control and in the same issue there will be an article on market gardening in Malaya.

A review of European refineries is given in **Petroleum** and the status of turbodrilling in the U.S.A. is discussed in the same issue.

Paint Manufacture introduces a new silicone paint system for heat and corrosion resistance and gives a guide to new synthetic resins.

Manufacturing Chemist this month has a special feature on Stop Valves and has articles on the New Penicillins and Building a New Chemical Plant.

Specimen copies of these journals can be obtained by writing to the Circulation Manager, 9, Eden Street, London, N.W.1.

A new flavour for your goods!

This new Mashed Banana is the *only* satisfactory banana flavouring on the market because it's *real* banana. Chiquita Mashed Banana is 100% pure (it has no additives!). And a patented aseptic canning process makes it sterile and preserves its full natural flavour and colour.

For further details of Chiquita Mashed Banana ask your usual distributor or — Elders & Fyffes Limited, 15 Stratton Street, London, W.1.

PEOPLE

MR. R. C. W. BANKS succeeds his father as managing director and MR. D. C. GORDON, who has been associated with Maconochie's and the Whiteside Group for many years, has been appointed director of sales of British Fish Canners, Ltd.

In addition, MR. N. O. F. JENSEN is now director of production and MR. G. T. BORNS has been appointed sales manager.

*

SIR IAN JACOB, G.B.E., C.B., is to be the first chairman of the Covent Garden Market Authority and MR. FRANK HOLLINS, C.B., has been appointed managing director and member of the Authority, while MESSRS. W. M. BALCH, CHARLES FORTE, HAROLD SAMUEL, ALEX SAMUELS, C.B.E., M. J. VEREY, T.D., and SIR THOMAS YATES, C.B.E., have been appointed part-time members.

*

MR. P. D. KELLY, laboratory technician from the Dublin sales office and factory of Coates Bros. (Ireland), Ltd., has been transferred to the company's Nairobi laboratory because demand for printing inks in East Africa has increased since the factory in Nairobi was opened last September.

*

MR. ANTHONY WALLYN has been appointed marketing director of Foodtech, Ltd., with overall responsibility for the sales of Foodtech products.

*

MR. C. A. C. DE BOINVILLE has been appointed president of the International Association of Seed Crushers, succeeding the late Mr. Guy Chipperfield.

*

An American, MR. JACK NIEDERMAIR, has joined the Supermarket Development Department of Mac Fisheries, Ltd. Mr. Niedermair, who studied retail food merchandising at the American University, Washington, D.C., was formerly with Safeway Stores, Inc., the second largest food chain in the world.

MR. DAVID GARDINER, first member of the fifth generation of the Palmer family to join Huntley and Palmers, Ltd., has been appointed a local director of their factory at Huyton near Liverpool.

◀ **Mr. D. Gardiner.**

Mr. D. F. Blakesley. ▶

On the acquisition of Blakesley, Browne and Co., Ltd., by Albrin Products, Ltd., MR. D. F. BLAKESLEY, former managing director, has joined the Albrin board as sales director.

*

MR. F. CLARK, managing director of Ross Frozen Foods (Birmingham), Ltd., and MR. M. E. BREWER, general manager of Tudor Dairies (Henley), Ltd., have been appointed managing director and executive director respectively of Tudor Dairies (Henley), Ltd., the Ross ice cream factory in Warwickshire.

*

MR. F. BRIAN HOLMES, M.INST.GAS E., chairman and managing director of W. C. Holmes and Co., Ltd., retired as managing director on October 31. He will retain his position as chairman of the company, of the holding company, B.H.D. Engineers, Ltd., and of those member companies of which he is at present chairman.

Mr. Holmes is succeeded as managing director by MR. A. J. M. HENSHAW, M.A.

DR. W. T. CROSBY, B.SC., PH.D., M.INST.F., M.INST.GAS E., was appointed to the board of directors on November 1.

MR. H. H. HOLCOMB, director of Armour and Company, Ltd., since December, 1960, has been appointed managing director. MR. T. D. LIVELY will continue as chairman of the board until January, when he will be returning to the U.S.A. Mr. Lively will, in Chicago, be associated with the head office of the Parent Company, International Packers, Ltd.

*

MR. J. A. WILEN, general manager, Research, Development and Quality Control, and MR. L. E. SULLIVAN, general manager, Manufacturing, have been elected directors of the H. J. Heinz Co., Ltd.

*

DR. D. H. SHARP has been appointed technical director of the F.B.I. as from November 1. He will take up the appointment on the retirement of the present technical director, MAJOR-GENERAL A. J. H. DOVE.

*

MR. T. THORNLEY, B.SC., M.I.CHEM.E., aged 75, has retired, after a distinguished career in the food industry, from the board of directors of N. Kilvert and Sons, Ltd. A dinner was held in his honour and he was presented with a set of matching luggage to mark his 35 years' service with the company.

*

MR. B. K. MORLEY has recently been appointed assistant home sales manager for Venesta Foils, Ltd. Mr. Morley, who joined the sales office five years ago, has been a representative for the past three years and was the youngest member of the sales force.

Obituary

We regret to announce the death on October 27 of MR. CECIL WARREN RODD, chairman of T. Wall and Sons, Ltd.

The photo shows (*l. to r.*) Mr. W. R. Johnston, director and secretary of N. Kilvert and Sons, Ltd., Mr. L. Jones, joint managing director, Mr. T. Thornley, and Mr. M. Freedman, works director.

Readers will remember this picture, which we published last April, of the late Mr. C. W. Rodd being presented with a rose bush.

Have you an opening for new flavours?

Sales go to manufacturers who are best equipped to stimulate a new demand with new flavours, as well as to satisfy existing demand for old and well-tried favourites.

SPICEMAX and SPICEMAX EMULSION spices and seasonings are combined within a FLAVOUR CONTROL SERVICE that includes:

1. **The development of exclusive new flavours.**
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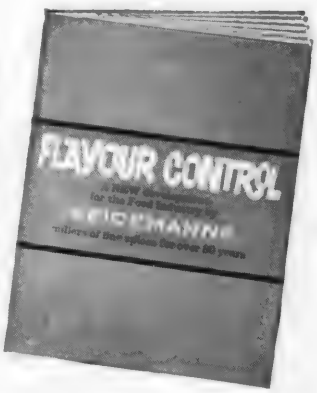
3. **Standard spices and seasonings; 'straight' or blended.**
4. **48-HOUR BATCHED DISPATCH SERVICE WITHOUT EXTRA CHARGE.**

We will gladly make a trial batch run at our expense, including your own costs.

This FLAVOUR CONTROL booklet can help you, particularly if you have a new product problem.



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MLB-S-2

OVERSEAS NEWS

ARGENTINA

New meat machinery installations

To help modernise their fast expanding unit in the Argentine, International Packers are installing medium pressure boilers and power plants.

The new installations at La Plata and Rosario in Argentina include specially designed steam boilers, turbines and auxiliary equipment geared to perform at top level efficiency while economising on operating costs.

The La Plata installation, 40 miles south-east of Buenos Aires, will power International Packers' manufacturing facilities in that area. The other installation will service the company's Rosario plant, 200 miles north-east of Buenos Aires.

AUSTRALIA

New filled milk regulations

An amendment to the Australian Customs Regulations prohibits imports of filled milk, except with the consent of the Minister. The amendment is designed to support State legislation to control the manufacture and sale of this product, which is separated milk with fats of vegetable origin added to replace the cream.

Silo to kill weevils

The Australian C.S.I.R.O. is building an experimental wheat silo in which (scientists hope) weevils will kill themselves by asphyxiation.

DOMINICAN REPUBLIC

Home wine industry favoured

Duty on home produced wine in the Dominican Republic will be halved to encourage the development of the industry. A special additional impost on all alcoholic drink will also be dropped in the case of Dominican wine.

A further development in favour of the industry is the recent adjustment in the price of sugar, which is a major raw material.

Coffee crop estimate

The estimate for the 1961-62 coffee crop is given as 80 million lb. Progress has been made on the Department of Agriculture's campaigns to encourage producers to provide shade in their plantations by the planting of rubber trees and also to halt soil erosion in certain areas.

GERMANY, WEST

Increase in self-service stores

In Western Germany an increasing number of people are buying their food supplies in self-service stores. One in every three DM.s spent on food is paid at a cash register of one of these stores, of which there are now more than 25,000 in the Republic.

INDIA

Brooke Bond acquire tea estates

Brooke Bond and Co., Ltd., have taken over control of the Doom Dooma group of tea estates in India. They acquired over 90% of the issued capital after increasing their bid to £3 a share.

Brooke Bond and Co., Ltd., also own big estates in East Africa.

JAMAICA

Supermarkets oust open markets

Fierce supermarket competition in rapidly expanding Kingston, where self-service stores are superseding the traditional open markets, where the produce is heaped on the ground, has caused the only daily newspaper in Jamaica, *The Daily Gleaner*, to introduce a much-needed weekly food supplement to draw attention to such items as pre-packaged foods, frozen foods, fresh fruit and recipes. At the same time the supplement is running a contest to encourage better display in the island's open markets.

PARAGUAY

Loan from West Germany for milk plant

The Cooperativa de Productores de Leche has reportedly been granted a loan of U.S. $150,000 by a West German firm.

A modern milk pasteurising plant will be installed with this money and machinery will be shipped towards the end of the year.

The plant is scheduled to be in operation by next April.

POLAND

Animal feed exports' steady growth

Polish exports of animal feeds has shown a steady growth for several years.

In 1960 $158,000,000 worth of animal feeds was exported by Poland, and another $100,000,000 has been exported in the first six months of this year.

TURKEY

Simon flour mill contract

Electric control equipment for a new flour mill at Sark in Turkey has been ordered from Brookhirst Igranic, a company in the Metal Industries Group, by Henry Simon, Ltd., of Stockport.

The equipment will automatically control the wheat cleaning, milling and storage plants.

The wheat cleaning plant will be operated by a panel with nineteen separate drives and supplies. The milling and storage plants will each have a 13-motor panel.

▸ The N.I.F.E.S. sixth annual progress survey, directors' report and accounts has appeared.

▸ A number of modifications to the range of *Type RBS Holmes-Connersville Positive Air Blowers* are described in a brochure published by W. C. Holmes and Co., Ltd.

▸ Intended as an elementary guide for the businessman, the Chamber of Commerce publication, *Goods by Air*, gives brief information on cargo rates, the difference between schedule and charter services, etc., and includes a list of airlines, forwarding agents and air-brokers. The publication, price 2s. 6d. post free, is available from the Chamber of Commerce, 68 Queen Street, London, E.C.4.

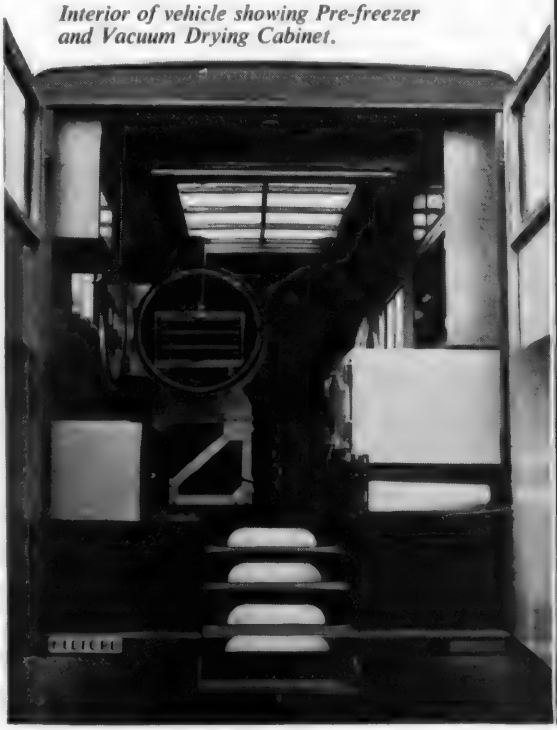
Mitchells Mobile Freeze-Drying Plant

Mitchell Engineering Ltd have designed and built a Mobile Freeze-Drying Plant for the demonstration and evaluation of this technique for food processors. This unit has been in continuous use at research stations and factories all over the country.

Mitchells have been actively engaged in developing Freeze-Drying techniques for ten years. In fact Mitchells built and installed the *first* commercial plant in this country.

Mitchells will be pleased to discuss the theoretical and practical applications of this process and can also arrange 'on-site' practical demonstrations of Freeze-Drying.

Interior of vehicle showing Pre-freezer and Vacuum Drying Cabinet.



A mobile Freeze-Drying research plant

MITCHELL

MITCHELL ENGINEERING LIMITED
(FOOD MACHINERY DIVISION)
100-104 THE BRIDGE, PETERBOROUGH, ENGLAND

SOLE AGENTS AND LICENSEES FOR
CHISHOLM-RYDER CO. INC.

FOOD

Manufacture

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Viscosity

The property of an oil which determines its rate of flow. A "thick" oil is one with a high viscosity, whereas a "thin" oil is one with a low viscosity.

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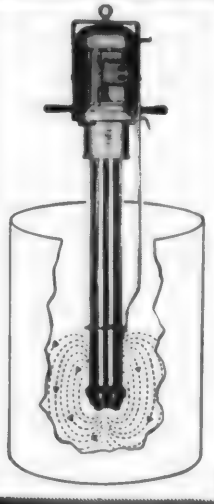

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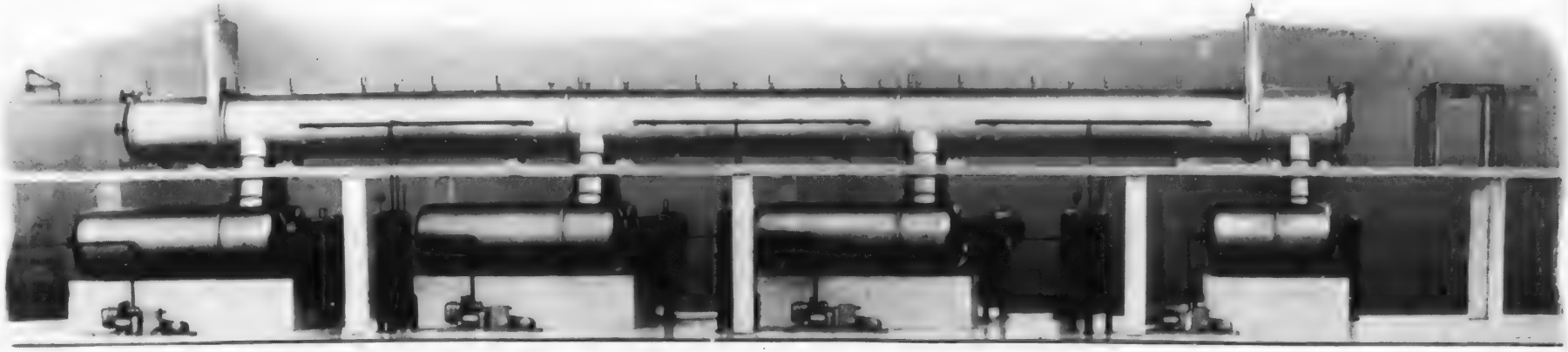

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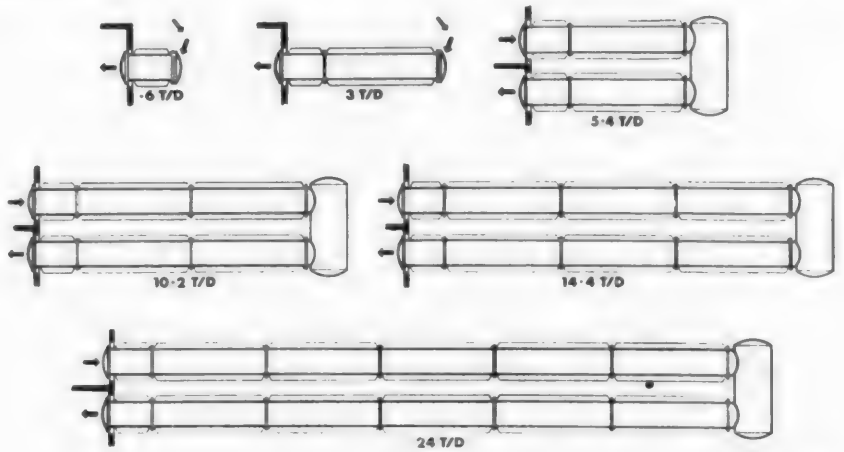

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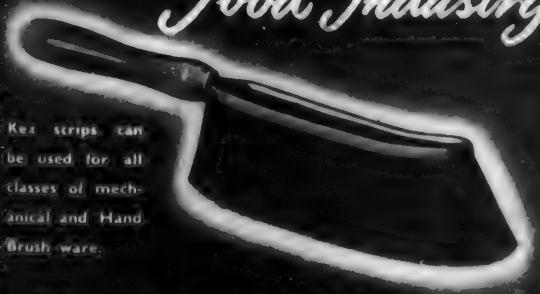

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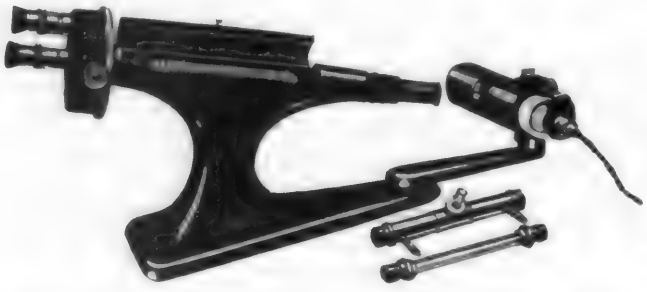

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Ref. B.681. British. Female. Single. Age 26. C. & G. Paper Technology. 10 yrs. Lab. Assist. i/c of Section, research laboratory—paper trade. Has taken Photographic & Communications Courses. Good exper. of photography, photomicrography, sectioning, microscopical analysis, photocopying, physical testing & devpt. Seeks post as **LAB. ASST.** London. £12 per week min.

Ref. B.682. British. Male. Married. Age 36. B.Sc. (Eng.). A.M.I.Mech.E. 5 yrs. Apprentice & 2 yrs. D/man, boilermakers & genl. ironfounders. 5 yrs. Site D/man/Engg. Clerk of Works/Contracts Engr., fuel advisory engrs. 3 yrs. Tech. Asst., woven wirecloth mnfrs. 9 mnths. Mech. Engr., consulting engrs. At present Project Engr. (Senr.), consulting engrs. Consid. exper. all phases of industl. & national power plant instlln., includg. control, co-ordination & supervision of contractors, site investigations, preparation & analysis of specifications & tenders, & subsequent control of payments. Seeks **TECHNICAL MANAGEMENT POST** with special reference to **MECH. PROJECT ENGG.** U.K. or Europe. £1,600 p.a. min.

Ref. B.683. British. Male. Married. Age 41. 21 yrs. incldg. apprenticeship with tool & gauge makers special m/cy. 3 yrs. Shift Supervisor, tool & gauge makers. 2½ yrs. Asst. Manager, mech. workshops, electro-mech. equipt. & electronic controls mnfrs. Good exper. electronic weighing components for prod. lines, food industry & mech. handling systems. Seeks post as **ASST. WORKS/PROD. MANAGER.** U.K. £1,350 p.a.

Ref. B.684. British. Male. Single. Age 21. 4 yrs. Income Tax work. At present Trainee Representative, mnfr. of abrasives. Seeks post as **REPRESENTATIVE OR TRAINEE WITH COMPANY PROVIDING COMPREHENSIVE SALES TRAINING PROGRAMME.** London. £700 p.a. min.

Ref. B.685. B.Sc. (Special Chem. & Subsid. Physics). 1 yr. Asst. to Chief Engr., devpt. of lead/acid batteries. At present Group leader of devpt. group, elec. components & light engg. Good exper. electrolytic processes & thermoplastics. Seeks **TECHNICAL LIAISON** post. London. £1,300 p.a.

(continued overleaf)

To: I.S.I.S. Appointments Register, 9, Eden Street, London, N.W.1. Please ask the following applicants to communicate with the undersigned:

Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....
Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....
Ref.:.....	**Ref.:**.....	**Ref.:**.....	**Ref.:**.....

Please use Block capitals

Name: .....

Position: .....

Company:.....

Business or Profession: .....

Address: .....

All introductions are made on the understanding that should an engagement result the employer agrees to I.S.I.S. Appointments Register's terms, which are as follows:

For each person engaged the equivalent of two weeks salary payable by the employer within fourteen days of the date of engagement.

Signature..... **Date**.....

I.S.I.S. APPOINTMENTS REGISTER *(Continued from previous page)*

Ref. B.686. British. Male. Single. Age 30. M.O.T. 2nd Class (Steam). M.O.T. 1st Class (Steam) Pt.A., G.M.I.Mar.E. 5 yrs. Apprentice, genl. engrs. 6 yrs. 2nd Engr., shipping company. 2½ yrs. Asst. Prod. Manager, genl. engrs. At present Asst. to Prod. Manager, crane mnfg. & genl. engg. Good exper. steam raising plant, turbine & diesel engines, refrig., power generation. Seeks post as **ASST. TO WORKS MANAGER**, or similar. S.W. England. £1,000 p.a. min.

Ref. B.687. British. Male. Married. Age 30. O.N.C. (Bldg.), H.N.C. (Bldg. Structures), A.M.I. Struct.E. 5½ yrs. Apprentice D/man, struct. engrs. 3½ yrs. Designer, consulting engrs. 1½ yrs. Designer, civil engrs. At present responsible for all Technical Work in office of struct. steelwork contractor. Seeks post as **EXECUTIVE DESIGNER** but will consid. **ANY OTHER SUITABLE APPOINTMENT.** Bristol area. £1,200 p.a. min.

Ref. B.689. British. Male. Married. Age 28. H.N.C. (Mech.), C. & G. Inter. (Mech.). Three 1st G.T.M.A. awards. 11 yrs. from Apprentice to Senr. Design D/man, jig & tool, special purpose m/cs. 2 yrs. Senr. Design D/man & Devpt. Engr., product devpt. At present Mech. Devpt. Engr., radio & T.V. mnfrs. Seeks post as **DEVPT. ENGR.** Middlesex area. £1,200 p.a.

Ref. B.691. British. Male. Married. Age 45. A.M.I.Plant E. 12 yrs. Marine Fitter. 2 yrs. Maintenance Engr., oil exploration. 2 yrs. Mech. Supt., public works dept. 2 yrs. Plant Manager, civil engrs. At present Plant Engr., aircraft devpt. Wide exper. instlln. & maintenance all types mech. & elec. equipt., & estimation admin., & costing of plant & mech. sections & depts. Seeks **PLANT PLANT MANAGEMENT / ADMINISTRATION** appointment. U.K. or abroad. £1,400 p.a.

Ref. B.692. British. Female. Single. Age 21. G.C.E. "A" level Physics & Maths. 1 yr. Mathematical Asst., R & D.—atomic power stations. At present Heat Exchanger/Superheater designer, mnfrs. of superheaters. Has taken course in Heat Transfer. Seeks post as **TECHNICAL/ENGG. ASST.** U.K.—not London. £625-£700 p.a.

Ref. B.693. British. Male. Married. Age 33. B.Sc. (Genl. Physics). B.I.M. Diploma. 10 yrs. Lab. Asst., chem. mnfrs. 4 yrs. Asst. Tech. Officer, chem. mnfrs. At present Technologist, joinery mnfrs. Exper. in R & D, tech. service, laboratory control, prod.& committee work. Seeks **ADMINISTRATIVE / MANAGERIAL APPOINTMENT.** U.K. £1,500 p.a. min.

Ref. B.694. British. Male. Married. Age 40. 25 yrs. exper. as Multi Spindle Automatic Setter, elec., diesel & mech. engrs. Seeks post as **MULTI SPINDLE AUTOMATIC SETTER.** U.K. £23 per week.

Ref. B.695. British. Male. Married. Age 28. H.N.C. (Mech. Eng.) & endorsements. G.I.Mech.E. 5 yrs. Apprentice Fitter & 2 yrs. D/man, cable makers. 1 yr. Design D/man, conveyor mnfrs. 1½ yrs. Design D/man, carton & bag makers. At present Asst. Works Engr., glass fibre mnfr. Seeks post as **ENGR. (WORKS MAINTENANCE OR DEVPT.).** U.K.—not London. £1,050-£1,150 p.a.

Ref. B.697. Indian. Male. Married. Age 26. **RESIDENT U.K.** O.N.C. (Eng. D/manship) & now studying for H.N.C. 3 yrs. Fitter, mining workshops. At present Fitter, flow valves mnfr. Seeks post as **JUNR. D/MAN.** Essex.

Ref. B.700. British. Male. Married. Age 30. 6 yrs. D/man. 2 yrs. Site Engr. & 2 yrs. Designer/D/man, civil contractors. 2 yrs. Civil Engg. Supervisor, petroleum engrs. 1 yr. Asst. Engr., structural consultants. 1½ yrs. Project Engr., pipeline & engg. consultants. At present Civil Engr., consultants. Exper. surveying, estimating, specification writing & genl. site duties. Seeks post as **CIVIL ENGR. (PREF. SITE WORK).** London, but willing to travel. £1,500 p.a. approx.

Ref. B.701. British. Male. Married. Age 33. H.S.C. (Physics, Maths. & Chem.). Now studying for A.M.I.C.E. 2 yrs. Clerk, bldrs. merchants. 2 yrs. Site Supervisor, civil eng. contractors. 3 yrs. Articled Pupil/D/man, civil eng. contractors. 5 yrs. Designer D/man/Engr., consulting engrs. At present Asst. Engr. (Civil), consulting engrs. Good exper. oil storage instlln., pipelines, land surveying, cathodic protection. Seeks post as **ASST. ENGR. (CIVIL).** London. £1,250 p.a. approx.

Ref. B.702. British. Male. Married. Age 22. Electronic & Mech. Eng. Workshop Training at college of electronics. O.N.C. Elec. Eng. (endorsement heat, light & sound). Now studying for H.N.C. 3½ yrs. Student Apprentice, radar & solid state physics research. 9 mnths. Quality Controller, colour photographic processors. 1 yr. Prod. Asst., govt. research. At present Tech. Asst. i/c small elec. laboratory, lighting mnfr. Seeks post as **JUNR. ENGR. OR TECH. ASST.** Gravesend or Central London area. £850 p.a.

Ref. B.703. British. Male. Married. Age 29. H.S.C. & H.N.C. 2 yrs. Trainee, marine engrs. 7 yrs. D/man & Engr., hospital & industl. autoclaves & ancillary equipment. At present Section Leader, chem, plant engrs. Seeks post as **ENGR./DESIGNER.** London or Middx. £1,100 p.a.

Ref. B.704. British. Male. Married. Age 58. A.M.S.E.Inc. 11 yrs. Apprentice & Workshop exper. & 2 yrs. Foreman, light engg. 6 yrs. Service Manager, radio service. 3 yrs. Sales/Service Engr., elec. products. 2 yrs. Works Manager, instruments. 19 yrs. Workshop Laboratory Supervision work, electricity generation. Good knowledge mech., elec. & electronic engg. as applied to instrumentation, tech. journalism, lecturing, German & Dutch. Seeks post appropriate to experience—pref. **ORGANISING/LIAISON OR APPRENTICE TRAINING AND SUPERVISION WORK.** Central or S.E. London. £900 p.a. min.

Ref. B.705. British. Male. Married. Age 40. Exper. includes 3½ yrs. Senr. Design D/man, radio, TV. & domestic appliances. 6 mnths. Senr. D/man, instruments. 9 yrs. i/c Office of Switch Mnfrs. At present Senr. Design D/man—special purpose m/cy, radio & TV. mnfrs. Good exper. jigs, tools, fixtures, s.p. m/cy, moulds. Seeks post as **SECTION LEADER OR CHECKER.** £1,200 p.a. London area.

Ref. B.706. British. Male. Married. Age 42. B.Sc. (Eng.), A.M.I.Mech.E. 8½ yrs. Apprentice/Sample & Trouble Inspector/Jnr. D/man, motor mnfr. 6 mnths. Works Manager, precision engrs. 4 yrs. Engr. W.S. Officer, heavy chem. mnfr. 5½ yrs. Head of Engg. Office/Plant Engr./Asst. to Works Manager, polish mnfrs. At present proprietor of own precision engg. concern. Has attended several Management Courses. Seeks post as **MECH. ENGR. OR PROD. EXECUTIVE.** London or W. England. £1,700 p.a. min.

Ref. B.707. British. Male. Single. Age 23. C. & G. (Mech. Eng.). S.I.Mech.E. 2½ yrs. Plant Engg. Apprentice, African engrs. Some knowledge workshop practice & technology, two-stroke petrol engines & automobile engines, & good exper. engg. dwg. Seeks post in **DIESEL ENGG. OR AS ENGG. D/MAN.** London area. £11 per week approx.

Ref. B.708. British. Male. Married. Age 25. B.Sc. (Civil Engg.). Parts A & B of A.M.I.C.E. 3 yrs. Engg. Asst., structural engg. (bridges). Has taken postgrad. courses in prestressed concrete design. Seeks post as **BRIDGE OR STRUCTURAL ENGR.**—very interested Reinforced & Prestressed Concrete Constructn. Paris or London. £1,200 p.a.

Ref. B.709. British. Male. Single. Age 28. B.Sc. (Mech. Eng.)—U.S.A. tech. college. 1 yr. Junr. Engr., bauxite mining (U.S.A.). Seeks post as **ASST. ENGR./DESIGN D/MAN.** U.K.—London area pref. £1,000 p.a. approx.

Ref. B710. Indian. Male. Single. **RESIDENT U.K.** B.Sc. (Physics) (India). B.Sc. (Eng.) Civil (India). 10 mnths. Asst. Engr., & 7 mnths. Designs & Engg. Asst., Indian Govt. Seeks post as **DESIGNER/DESIGN ASST. (CIVIL ENGG.).** U.K.—London area pref. £16 per week approx.

Ref. B.712. British. Male. Married. Eng. Grad., A.M.I.Mech.E., B.O.T. Nat. Cert. M.Inst. Packaging. 5 yrs. Apprentice, marine engrs. 1 yr. Research Asst., cement mnfrs. 10 yrs. from Fitter to Asst. to Chief Engr., in engg. dept. of drug mnfrs. 3 yrs. first as Resident Engr., on construction & equipping of large chem, factory & then as Works Engr., engaged in commissioning, devpt. & maintaining factory, incldg. staffing & managing engg. sections. 1 yr. Metal Trades Supervisor & Admin. Asst. to Refinery Maintenance Superintendent, petroleum company. 2 yrs. Prod. Technical Manager, responsible all aspects prod., bldg., & engg. activities, pharmaceutical company. Seeks post as **ENGR. OR WORKS MANAGER.** Slough area pref. £1,750 p.a. min.

Ref. B.715. British. Male. Married. Age 34. D.F.H., Grad. I.E.E. Apprenticeship with elec. engrs. 6½ yrs. Asst. in Purchasing Dept./Divisional Buyer/Works Buyer/Raw Materials Buyer, cable mnfrs. Seeks post as **PURCHASING MANAGER**, but also interested in **SALES OF ELEC. GOODS OR TO ELEC. INDUSTRY.** London area or Kent or U.S.A., Canada, Australia or New Zealand. £1,750 p.a.

Ref. B.716. British. Male. Married. Age 42. 1 yr. Elec. Inspection, aircraft mnfrs. 7 yrs. Inspection Supervisor, radio & TV. At present Tech. Liaison & Sales Engr., mnfrs. radio & TV.—also concerned with provision of press tools for metal work & moulds for plastic work. Seeks post as **TECH. REPRESENTATIVE OR LIAISON ENGINEER.** U.K.—not London. £1,300-£1,500 p.a.

Ref. B.717. British. Male. Married. Age 33. H.N.C. (Mech.), H.N.C. (Prod.) & endorsements. A.M.I.Mech.E. 4 yrs. Apprentice, aircraft mnfr. 1½ yrs. Planning Engr., aircraft mnfr. 1 yr. Jig & Tool D/man, calculating m/cs. 2 yrs. Design D/man, heating & ventilating. 3 yrs. Design Engr., aircraft mnfrs. 4 yrs. Project Design Engr., nuclear power. At present Senr. Mech. Engr., TV. industry. Has taken 2 yr. course in Nuclear Power. Author of published paper on university reactors. Lecturer on mech. eng.—applied mechs, heat engines, workshop practice & tech. dwg. at evening institutes. Seeks post as **MECH. OR PROD. ENGR.** London, S. Bucks., Berks. or Herts. £1,500 p.a. min.

Ref. B.718. British. Male. Married. Age 40. A.Inst.Ex.Engrs. 4 yrs. Apprentice, engrs. 4 yrs. Designer/D/man, genl. engrs. 2 yrs. Foreman & 7 yrs. Works Manager, light engg. 1½ yrs. Works Manager, engg. At present Works Manager, elec. light fitting mnfr. Exper. in dust control systems, s.p. m/cy for plywood industry. Seeks post as **TECH. REPRESENTATIVE / SUPERVISORY ENGR.** U.K. £1,200 p.a.

Ref. B.719. British. Male. Married. Age 38. H.N.C. Mech. Eng. 5 yrs. Fitter, water treatment equipt. 1 yr. D/man, electronics. At present Design D/man, radio & TV. Seeks post **"OFF THE BOARD"**—e.g. **CUSTOMER LIAISON/DEVPT.** or as **ASST. CHIEF D/MAN.** London. £1,350 p.a.

Ref. B.720. British. Male. Married. Age 37. O.N.C. (Mech.). 5 yrs. Senr. D/man, radio & TV. mnfrs. 8½ yrs. Chief D/man, radio & TV. mnfr. 1½ yrs. Prod. Manager, tape recorder & amplifier mnfr. At present Prod. Manager, light mnfg. engg. company. Good exper. control male & female staff in D.O. & factory. Seeks post as **CHIEF D/MAN OR PROD. MANAGER.** London. £1,550 p.a.

Ref. B.721. British. Male. Single. Age 22. At present studying for O.N.C. on day release. 2 yrs. Detail D/man, civil engrs. 3 yrs. Site Engr./Agent/Detail D/man, structural engrs. At present Detail D/man, structural engrs. Seeks post as **D/MAN**—if possible with one day off per week for study. London. £700 p.a.

Ref. B.722. British. Male. Married. Age 24. O.N.C. & now studying for H.N.C. 5 yrs. Apprentice toolmaker, pressure valves. At present Design D/man, parcel tying m/c specialists. Seeks post as **DESIGN D/MAN.** London or S. England. £900 p.a. approx.

Ref. B.723. British. Male. Married. Age 47. O.N.C. (Elec.), M.I.E.D. 5 yrs. Works Trainee, & 1 yr. Junr. D/man, transformer & switchgear mnfr. 2 yrs. Junr. D/man, telephone equipt. 7 yrs. Leading D/man, telecommunication equipt. 13 yrs. Senr. Designer/Asst. Chief/Chief D/man, power rectifier & assoc. control equipt. At present Chief Engr., domestic refrigeration. Good exper. control Design & Jig & Tool D.O., planning & process engg., factory layout & method study. Seeks post as **CHIEF D/MAN OR CHIEF PROD. ENGR.** London area. £1,500-£1,600 p.a.

Ref. B.724. British. Male. Married. Age 29. H.N.C. (Mech.), Student I.C.E. 4 yrs. Junr. Engr./Site Engr., water undertaking. 1 yr. Design D/man, industl. consultants. 1 yr. Design D/man, oil company. 1½ yrs. Tech. Asst., local govt. consultants. At present Devpt. Engr., engg. consultants. Good exper. water, drainage, hydraulic structures. Seeks post as **ENGR.** S. England. £1,100 p.a. min.

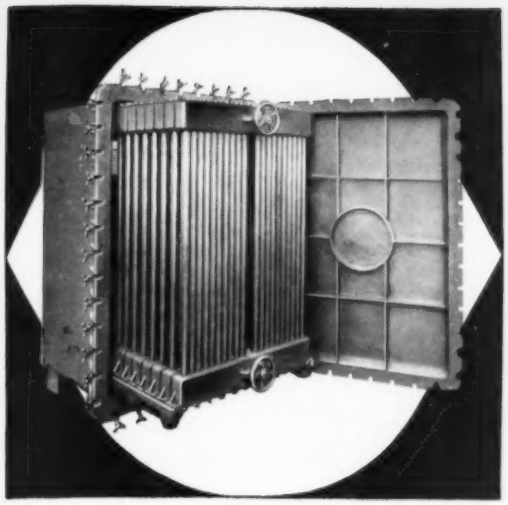
Ref. B.725. British. Male. Single. Age 41. O.N.C., M.O.T. 10 yrs. Watch-keeping Engr., shipowners. 3 yrs. Engr.—erecting dredges, mining engrs. 2 yrs. Foreman Millwright, chem. plant constr. engrs. 1 yr. Site Engr., genl. engrs. 1½ yrs. Foreman Millwright, engrs. At present Foreman, boiler plant erection engrs. Wide exper. instlln. all types plant, speaks Spanish & Malay. Seeks post as **ENGR.** Abroad—S. America pref., but U.K. consid.—U.K. salary £20 per week.

Ref. B.726. British. Male. Married. Age 44. B.Sc. (Metallurgy, Physics & Chem.). 2 yrs. Devpt. Engr., bearing devpt. 4 yrs. Metallurgist, metal recovery. 9 yrs. Senr. Metallurgist, light mech. & elec. engrs. 2 yrs. Chief Devpt. Metallurgist, founders & engrs. 6 yrs. Chief Metallurgist & Asst. Chief Engr., light mech. & elec. engrs. 1½ yrs. Chief Engr., light elec. & mech. engrs. Seeks **TECH./PROD./ADMIN./SALES APPOINTMENT.** S. England. £1,500/£2,000 p.a.

Ref. B.727. British. Male. Married. Age 48. Studied to Inter. B.Sc. (Eng.). Exper. includes 1 yr. Engg. Asst., drainage dept. 3 yrs. Engg. Asst., local authority. 1 yr. Asst. Resident Engr., local authority. At present Director & Engr., civil engg. contractors. Specialised in Main Drainage, Water Mains, design & constr. of industl. bldgs. in concrete & prefab. sections in precast concrete & timber. Seeks post as **CIVIL ENGR.** U.K. £1,750 p.a.

Ref. B.728. British. Male. Single. Age 22. B.A. (Mech. Sciences). 10 months, Asst. Maintenance Engr., agric. research station. Seeks post as **GRAD. APPRENTICE** in Civil Engg. S.W. England. £650-£700 p.a.

Ref. B.730. British. Male. Married. Age 37. Engg. Diploma. Grad.I.Struct.E. 9 yrs. Civil Design D/man, chemical & plastics mnfr. At present Senr. Plant Engr., aircraft & guided weapon mnfr. Good exper. supervision labour & control design & clerical staff, surveying, liaison work & estimating. Seeks post as **BLDGS. MANAGER/WORKS MANAGER OR TECH. REPRESENTATIVE** in bldg. materials. London or Home Counties. £1,250 p.a.



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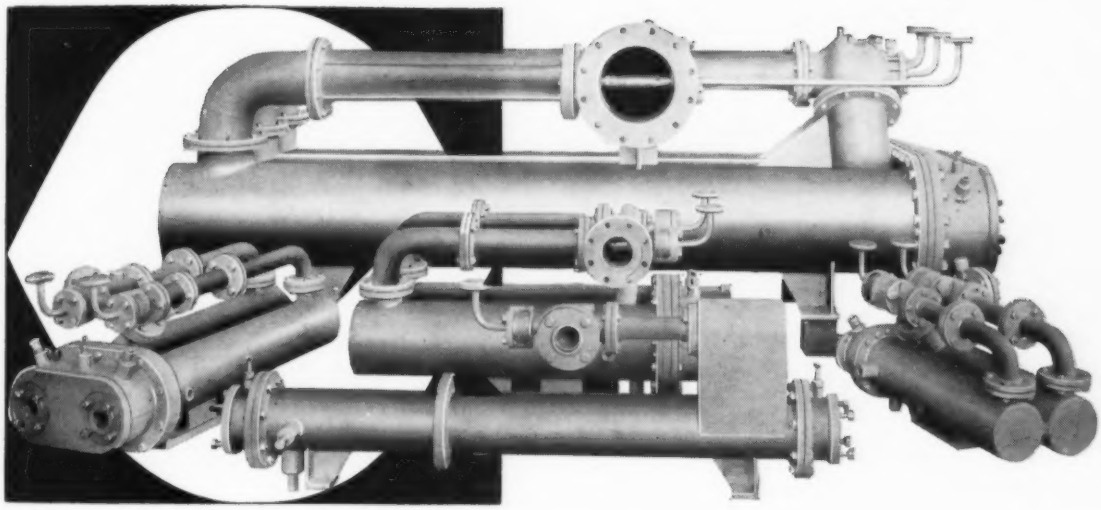

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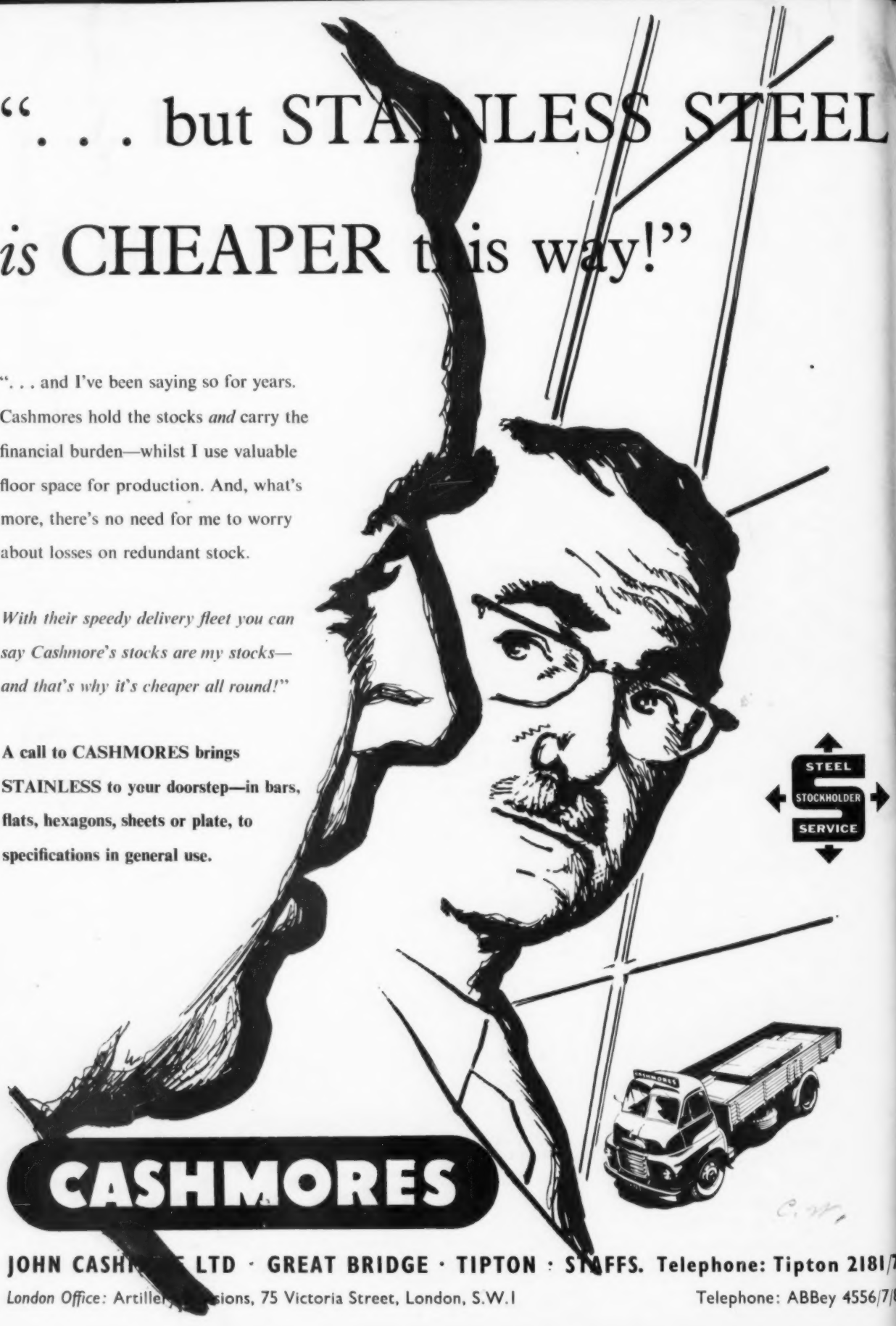

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